

Making a Pan Brake "Folder with fingers" for home

By Simso

Taken from:

<http://www.woodworkforums.com/showthread.php?t=45792>

Okay, just a quick overview of what were dealing with here. Grahame posted up recently a topic about handiest tool you've made for metalwork, I posted a pic of my panbrake"folder with fingers" and through Pm's from people wanting more info, I have decided to start a thread with step by step guide to how to make one. This will take a sheet of steel up to 600mm wide and bend 1.6mm mild steel nice and sharply. If you want to be able to bend thicker steel sharply then you can and Ill point out which bits need to be beefier as I go along. For the purpose of this exercise Im actually going to help a local mate build one and Ill organise photos on the way, so that way you can see whats actually involved in them. Theres a bit of welding a bit of milling and a bit of lathe work, if you don't have access to a mill, lathe or a 20 and 25mm drill bit then I recommend maybe getting the bits laser cut out, Ill give you a rough costing of how much these cost as well.

Total cost of unit in materials 2 years ago anyway wont go over 80 bucks, if you get bits laser or plasma cut then maybe 150 all up, not bad when you consider a commercial unit of this strength and quality will cost you around 1600.

What can I bend with this unit, well I use this for making my own tool boxes at home and I restore old cars,so as you can imagine for restoration it is absolutely unbelievable. I made one for a mate who works in the panel and paint business, he uses this unit every day just to make the rust replacement bits for the cars, and were talking from mazdas to mercedes.

A lot of the shape to these bits is purely asthetical, I made my very first unit out of square edges act, worked great looked like crap. But it worked, its your call

I lost all the computer files a while back "hard drive crash", I have my original hand drawn ones and some printed cad drawings, so I may take a while with some of the photos pics as Ive got to redraw them

On my pictures youll see the following notes

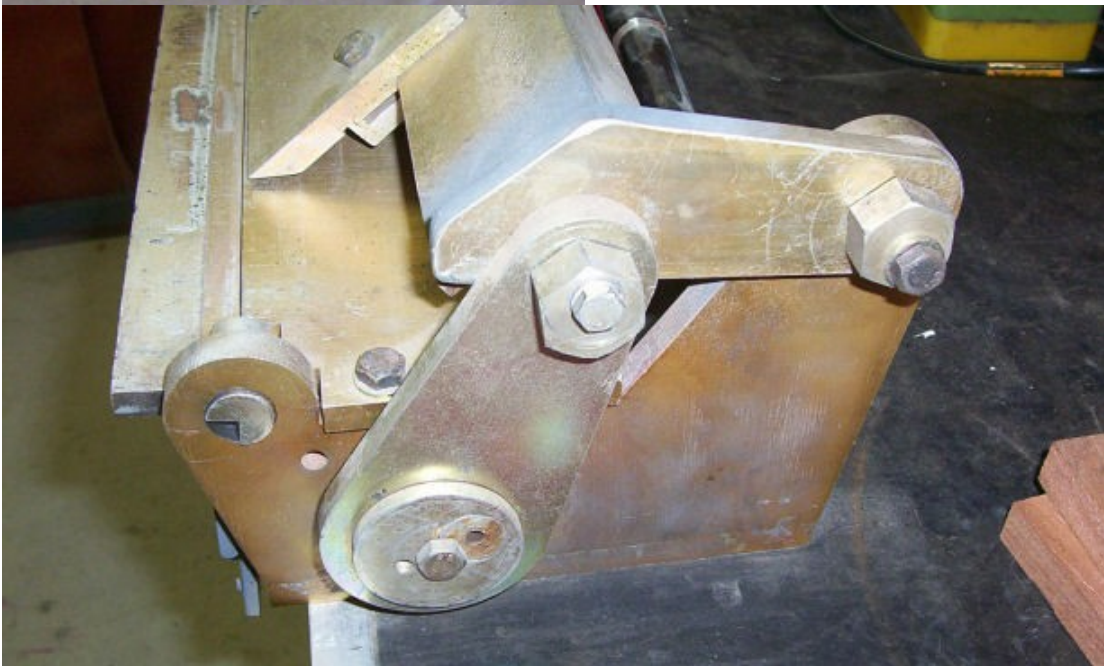
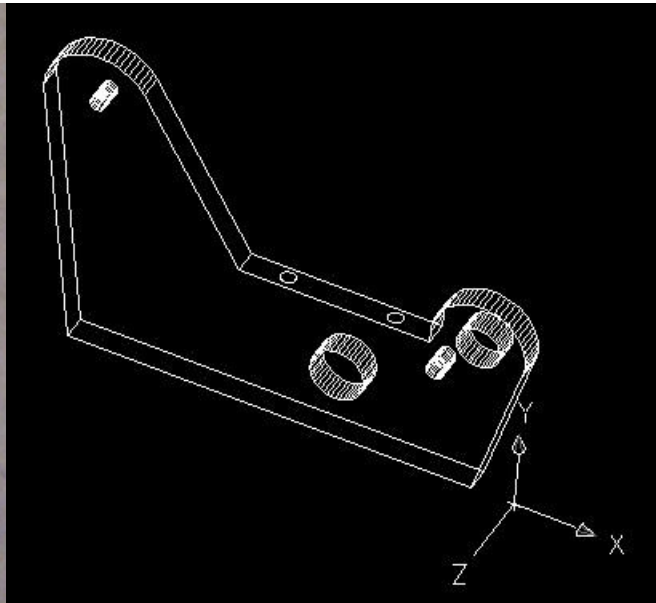
125,35 This is a cad co-ordinate, or for your ruler from the corner of your paper 125mm across and 35mm up is the point at reference

D/T=Drill and Tap

D = Drill

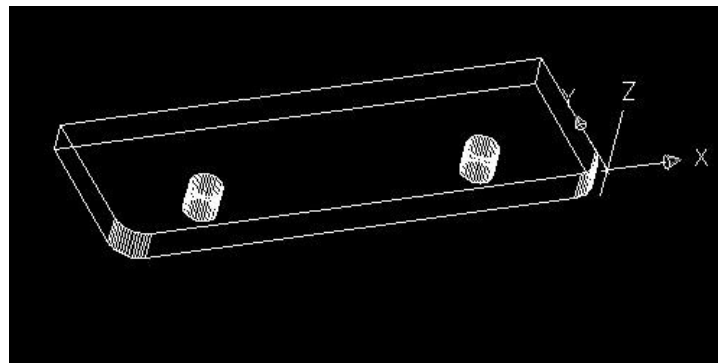
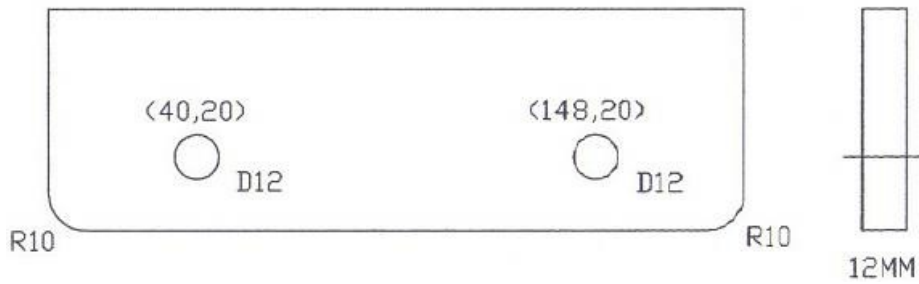
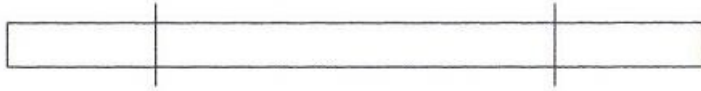
R = Radius



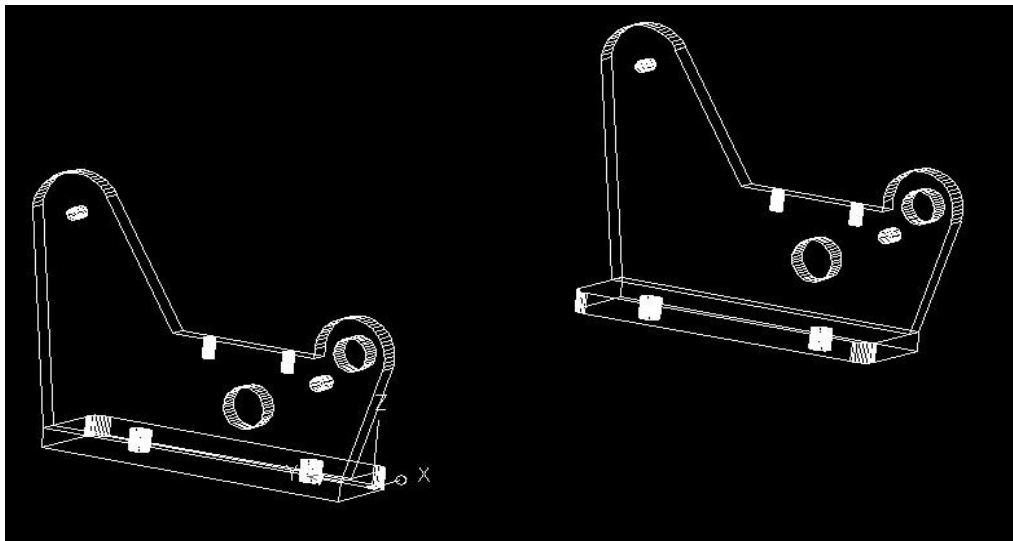


Step 2. Foot end piece, nothing complicated here, its just 2 lumps of steel that's going to be welded in step 3 to the end pieces from step 1, all it does is provide some rigidity for the end pieces and a means of clamping them down to a bench hence the holes. If you want it can be just a flat piece of steel with no holes etc.

Foot End Piece Qty 2
12MM Flat Steel 188 x 60

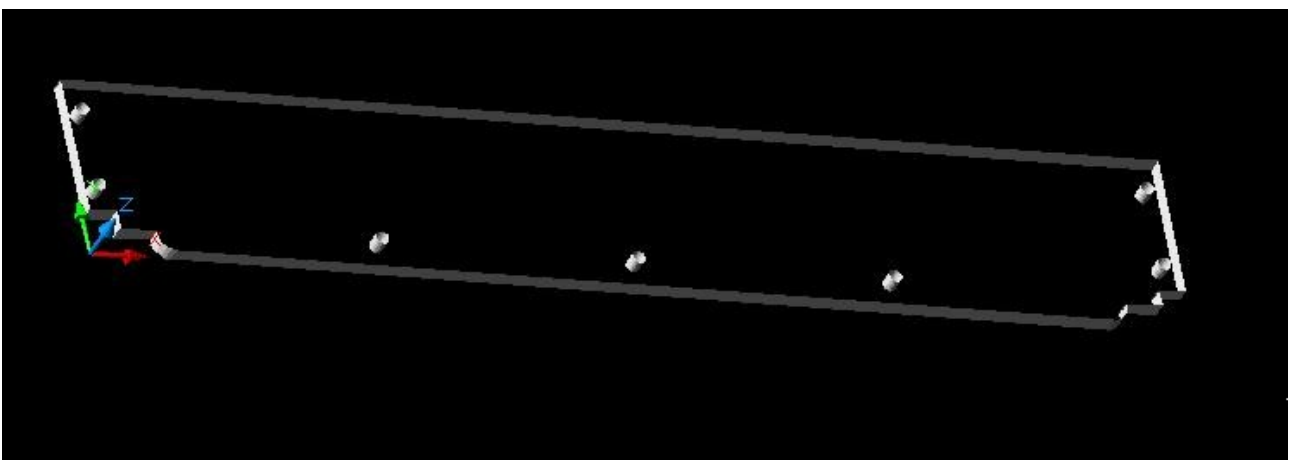
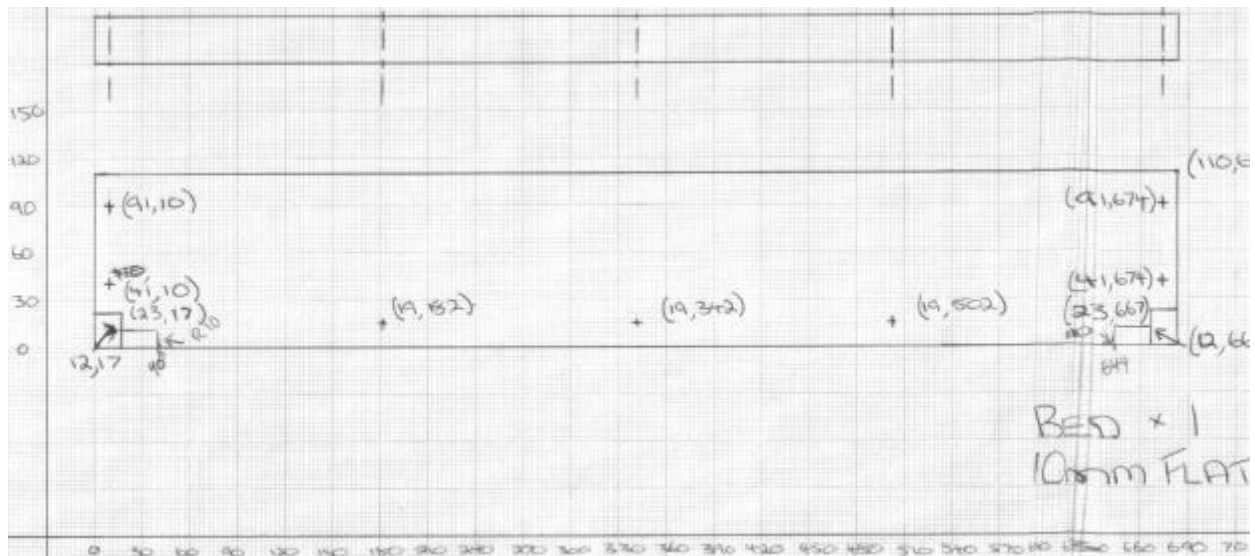


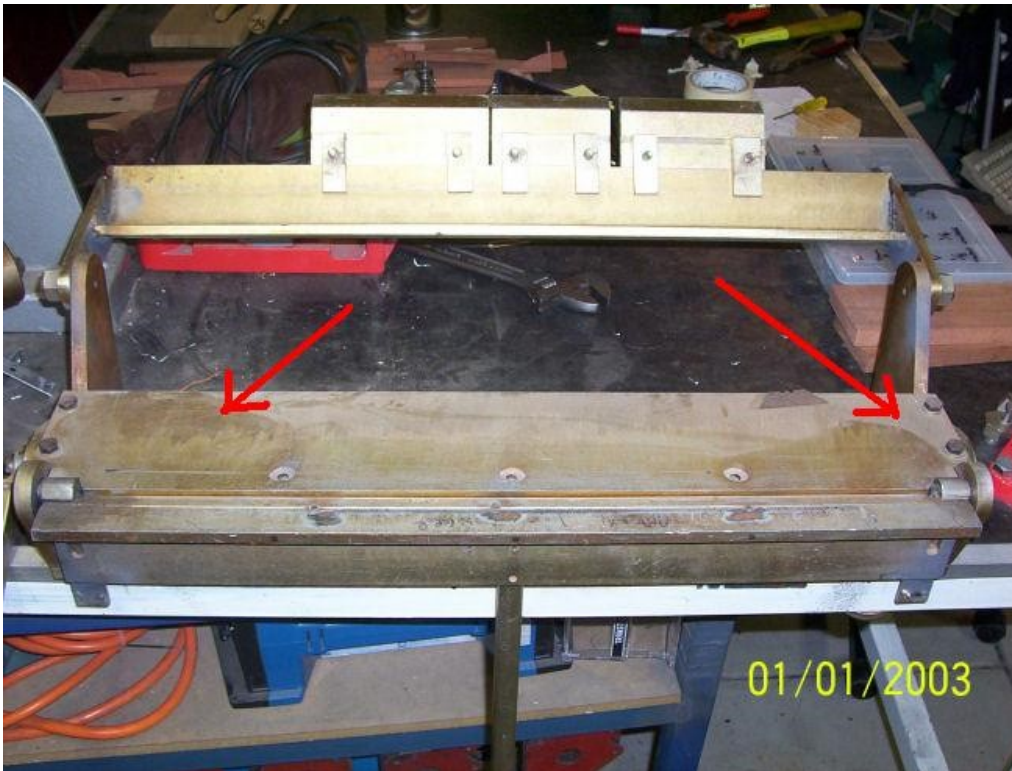
Step 3. Okay all you've got to do here is simply weld item 2 onto the bottom of the end piece run a couple of stitch welds on the inside and tack it 3 places outside, grind the outside ones flush for aesthetics. Make sure the pieces face inwards respective of which end they are on eg left and right. If you cant weld the item then drill 2 holes 8mm in size up through the end piece foot and tap 2 m8 holes in the bottom of the end pieces and simply bolt them together.



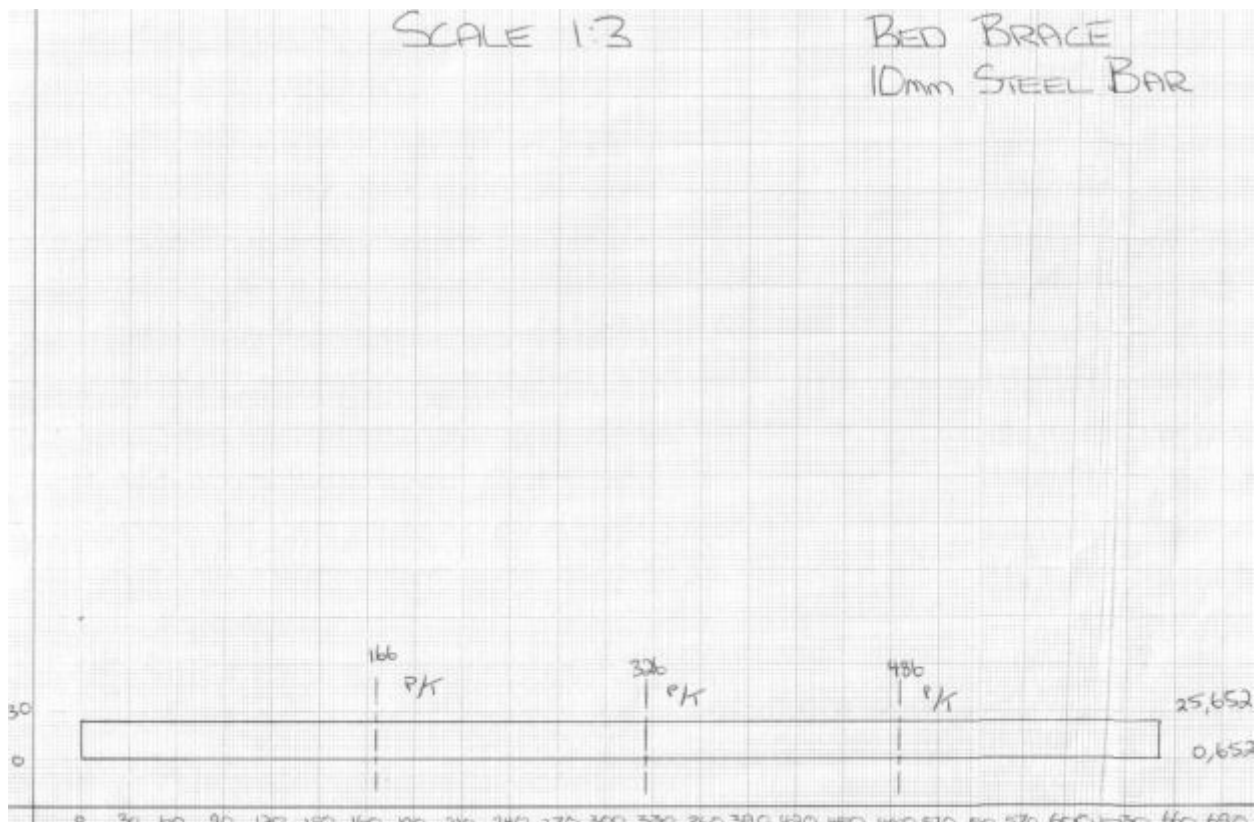
Step 4. Flat Bed piece, okay this piece is simply flat bar 684mm long by 110mm wide with a material thickness of 10mm. The two end holes on both sides are 8mm and allow the bed to be bolted down with m8 bolts to the end pieces, thereby creating the folder base frame. The first notch you see in the corner allows the bed to sit around the end piece, with this in mind if you cant get a piece of steel 110 wide but in fact wider say up to 150mm then its not a problem youll just have to do a similar notch on the back edge for whatever deviation you go by. Eg 150mm requires a rear notch of 40mm and so forth. Okay the second notch on the front you see is for clearance of the lifting assy pivot point, have a look at the completed picture to get a better understanding if required.

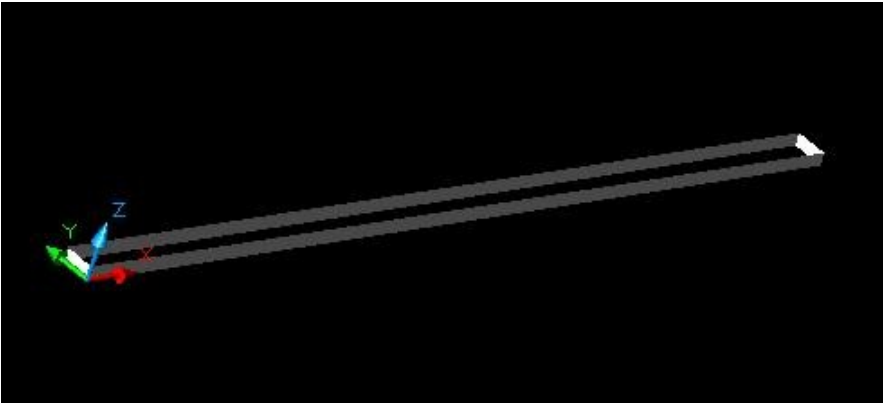
Through the center there are 3 holes 8mm in dia these are for the attachment of the brace in step 5 for rigidity, obviously you will have to countersink the tops so that way the heads of your bolts are not sitting proud, if your happy welding the underneath brace then don't bother drilling these holes, they are there solely for the drilling and tapping method of assy. Okay that's pretty much it for this step, have fun now



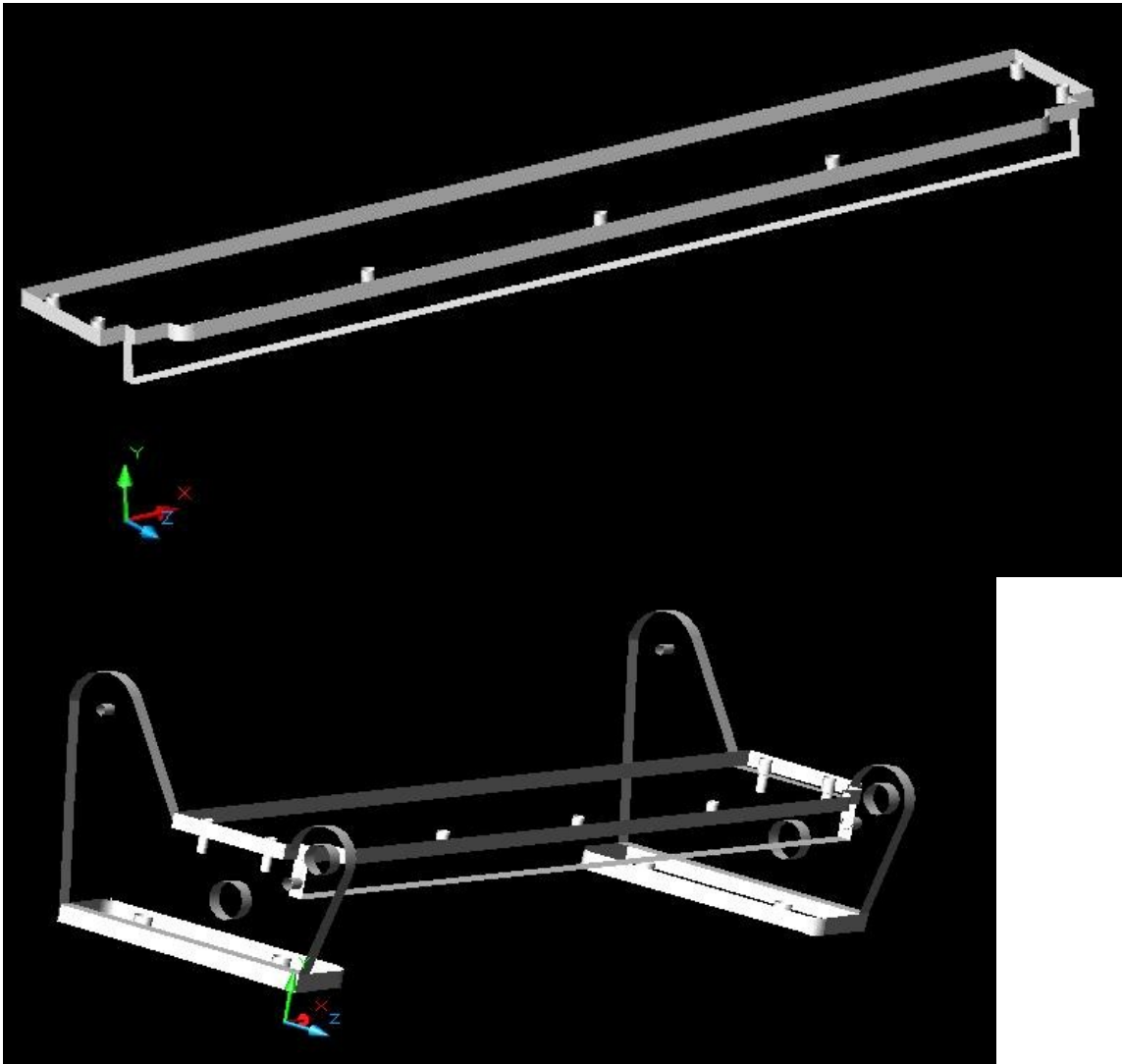


Step 5. Flat Bed brace piece, this is solely to add ridgitiy to the bed so that way when you bend say a 1.6mm piece of steel the bed base wont bow on you, trust me it will if you don't fit it. Okay its flat steel again 10mm thick, 652mm long and 25mm high, you can use up to 50mm wide for extra ridgitiy or if you cant get it for some reason in the 25mm range





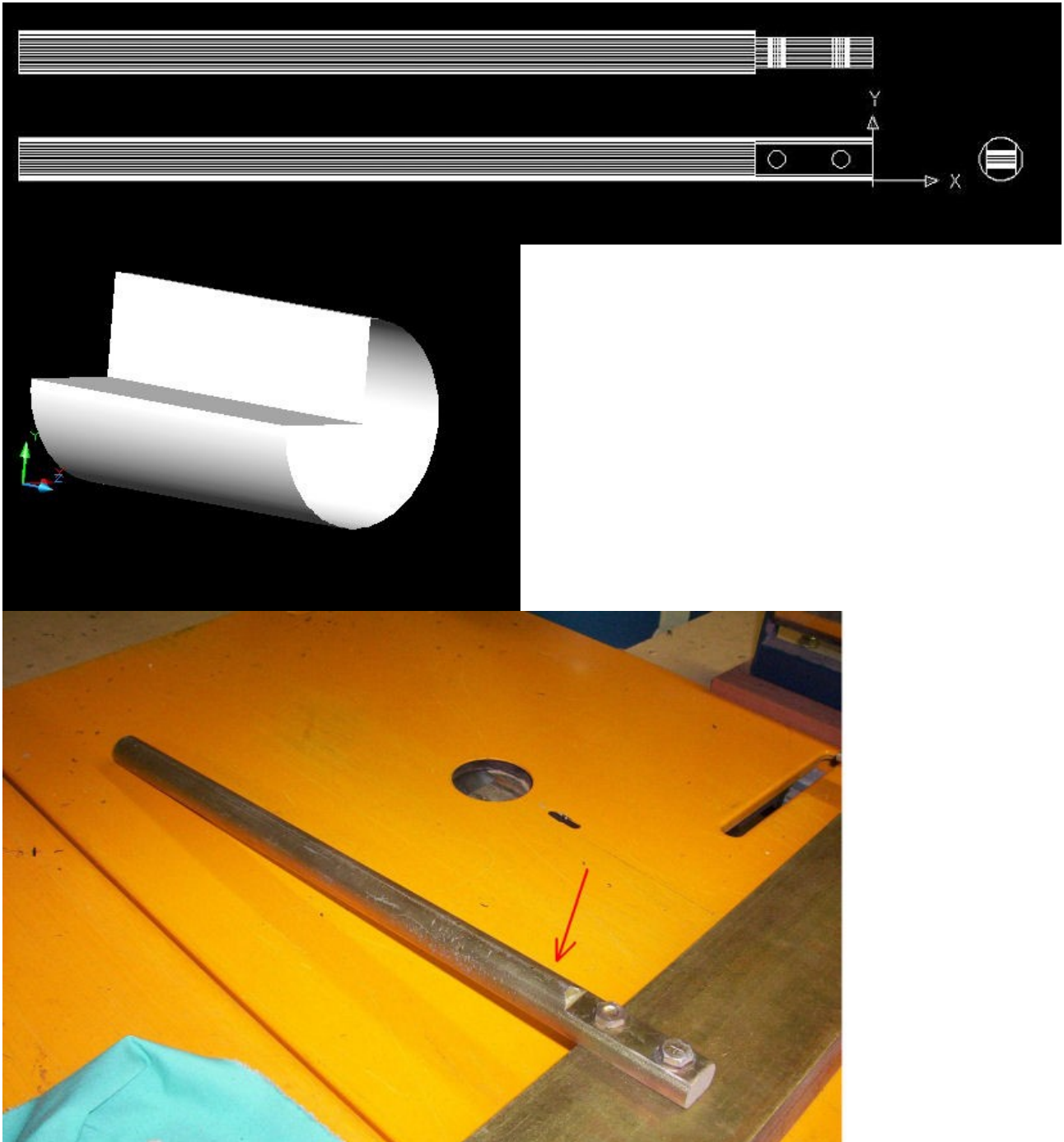
Step 6. Okay lets fit the two pieces from step 4 and step 5. The flat bed is simply bolted down using two m8 bolts on the end pieces from step 3. That's it. Now place the flat bed brace bar underneath the flat bed and clamp it along the center line 19mm back from the front edge, if you drilled the 3 center holes from above you'll see the steel dead smack underneath you. Have a look on the end pieces as well it should cover the 8mm holes you drilled on both sides. Okay drill and tap the flat bar from the end pieces first. Now bolt them up with m8 bolts. You can remove your clamps. If you drilled the three center holes through your flat bed then now continue these three holes into the flat bed brace using a 6.8mm drill and then tap them m8, dont forget to countersink the holes on the flat bed as required by whatever fastener heads your using, its got to be a flush surface remember. If you didn't drill the three holes then stitch weld from underneath the flat bed brace onto the flat bed





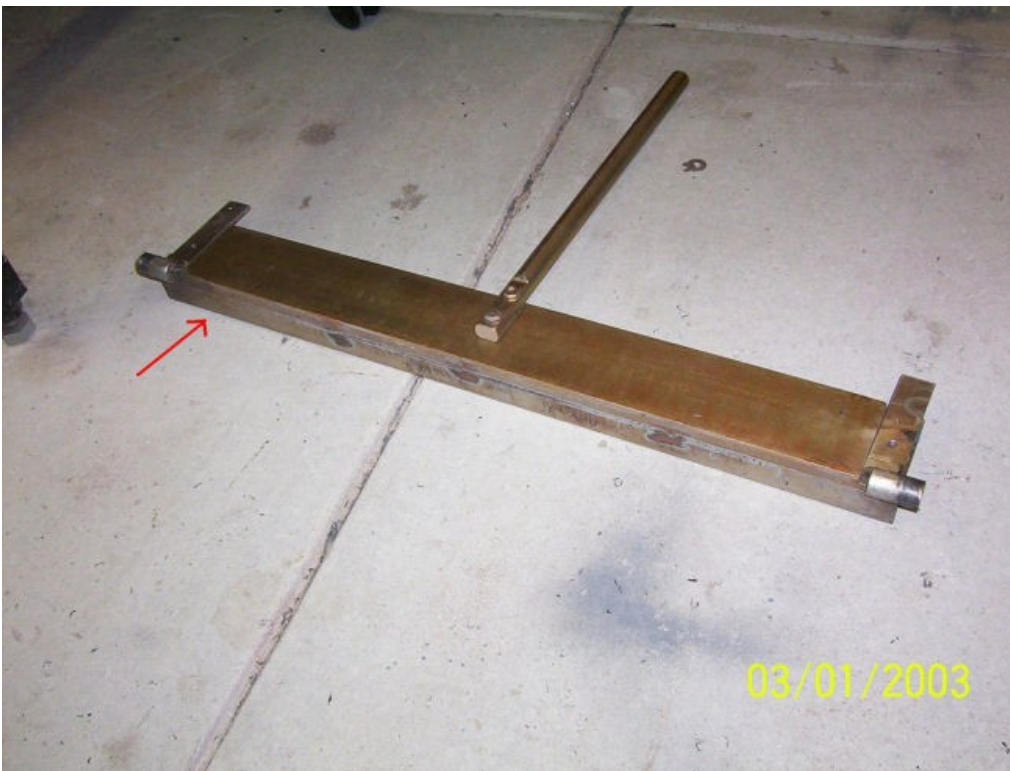
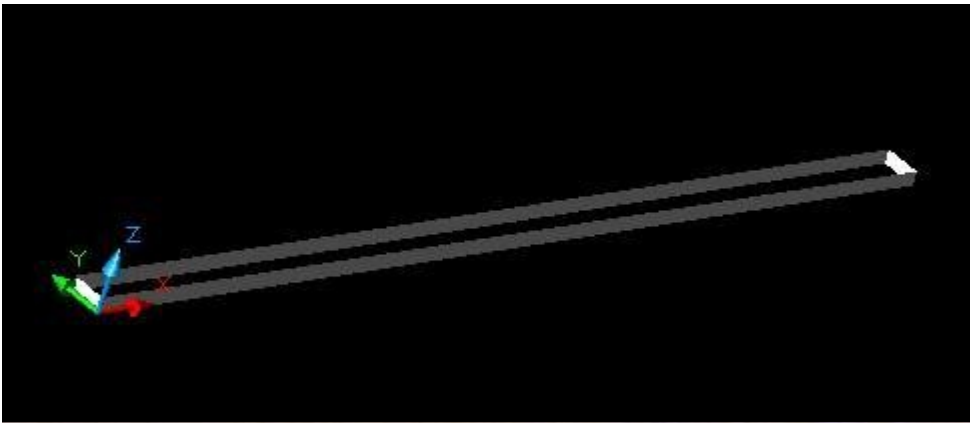
Step 7. Lifting assy handle and locating guides are simply made out of 20mm round stock. The handle is 400mm long and 20mm round, it can be longer if you wish or shorter. I mill both sides of one end down by 3mm per side with a milled length of 55mm, you could also easily file this shape in as well, its not critical, the flat surfaces are a means of allowing the handle to sit flush with the lifting arm. There are two 8mm holes and these are center located from the end 10mm and 40mm.

These are here so you can bolt the item to the lifting arm, if your happy once again welding the item in place then disregard drilling the holes and just weld the handle in place when the time comes The locating guides are included into this step because they are 20mm round as well, you need qty 2 and they have a length of 35mm, find the end center of each piece and mark it out so you have 4 perfect quarters. Remove one complete quarter for the full length, file it, mill it, it doesn't matter just remove one quarter. After you've done this test there fit against the end pieces, these go into the 20mm holes at the front, sand grind ect to make a nice smooth fit, your goal is to have them turn smoothly in the end pieces, and yes you do use grease when assembly comes, so you can test them with grease as well
Okay that's this step completed

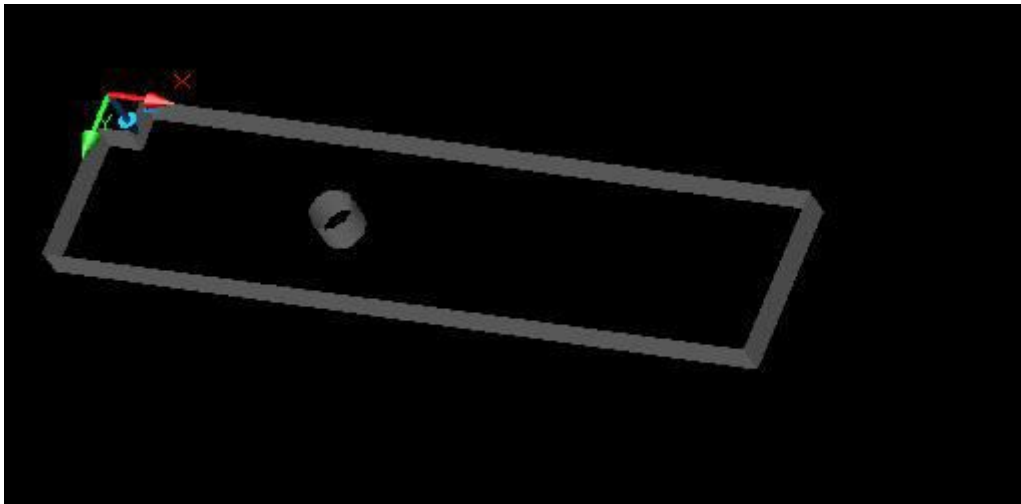
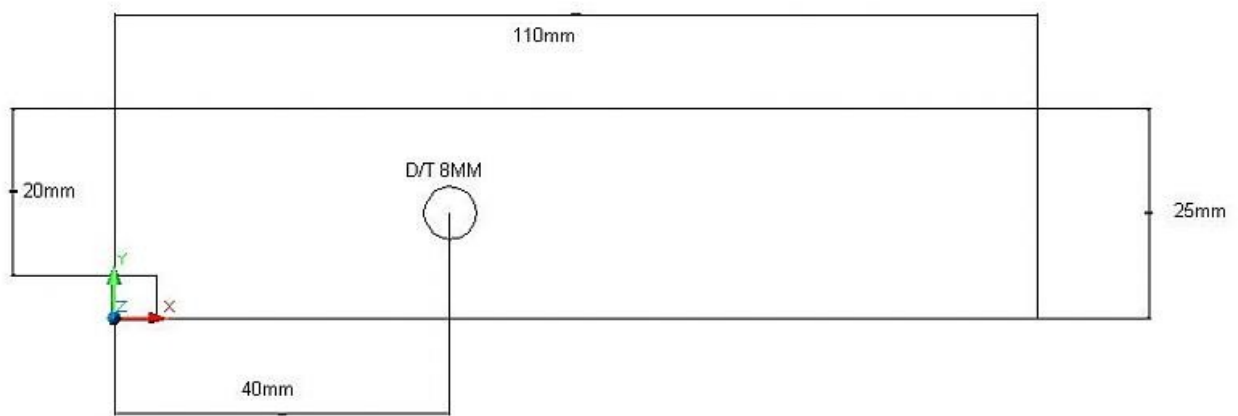




Step 8 Lifting assy brace piece, this is exactly the same piece as you made for the bed brace, its flat steel 10mm thick, 652mm long and 25mm high its purpose is to extend the 10mm edge you have on your lifting assy and help assist in the fold. For those that don't know trying to bend a piece of steel with a 10mm edge is really horrible, you have this sheet of steel hanging out and swaying everywhere, you also start getting creases in your steel ect when you try to bend it, hence the requirement of this piece, it extends that 10mm edge and turns it into a 35mm edge, If you want you can use a wider piece than the 25mm bar, but the wider you go the more it intrudes into working space around the folder.

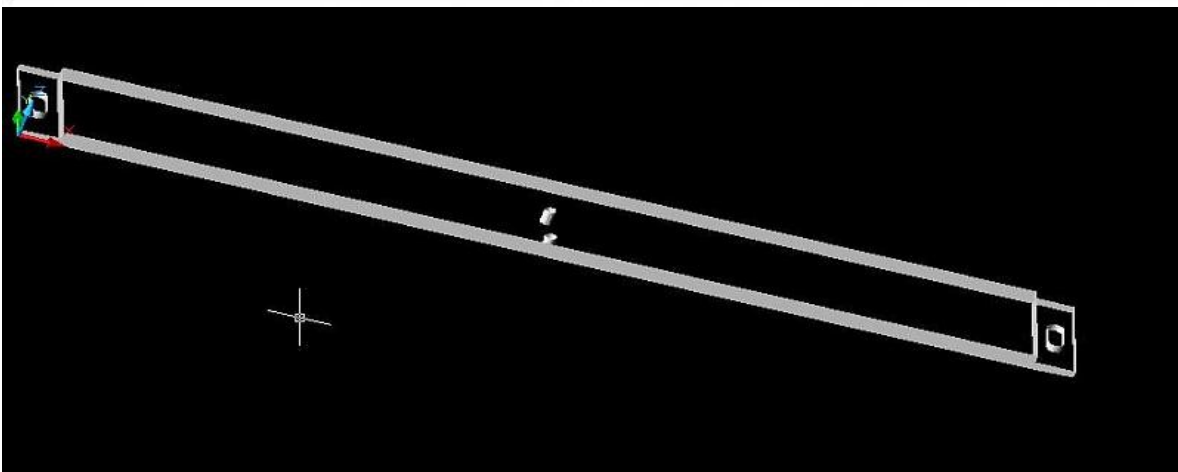
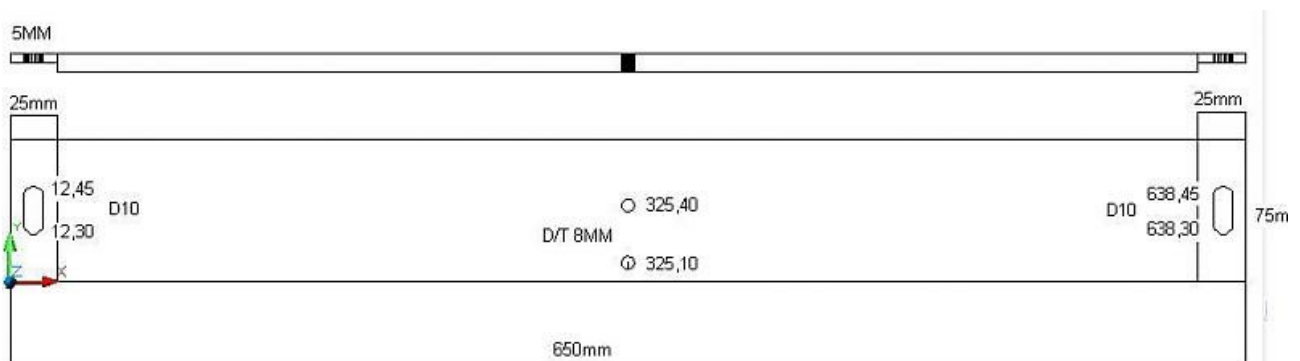


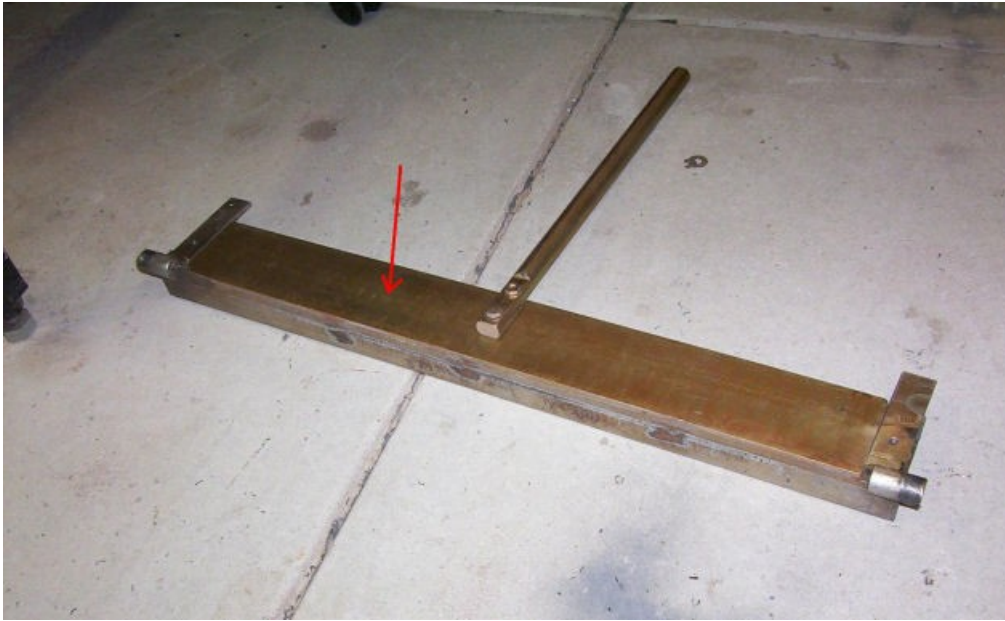
Step 9. Really easy one, you need two of these, this is a flat piece of 5mm thick steel 110mm long and 25mm wide. It has a 5mm by 5mm notch in one corner and this is here to allow you to put a blob of weld on it later. The hole is central and 40mm away from the edge, its an m8 size drilled and tapped. The purpose of this piece is to allow the lifting assy to be moved closer or further away from the bed assy. The closer you get the sharper the bend radius on the item you fold, the further away the rounder the bend radius you get on the folded job. That's as difficult as it gets





Step 10 Okay this is the last step for component making for the the lift assy, in the next step we will put all these bits together. This item is a piece of 10mm flat bar 650mm long and 75mm wide, if you want wider like a 100mm then thats fine as well but you cant vary the 650mm length There are two slots, one on each end, drill these with a 10mm drill at the co-ordinates ive written and then simply file the gap or mill between the holes. The two holes in the centre are drilled and tapped for an m8 thread, this is were you will bolt up your handle from the earlier step. You have to mill both 75mm width ends as shown in the drawing down to a thickness of approx 5mm and a width of 25mm. The adjustment slides you made before in step 9 need to sit neatly and flush at these points. If you want to this can be laser cut as well for about 15 bucks.



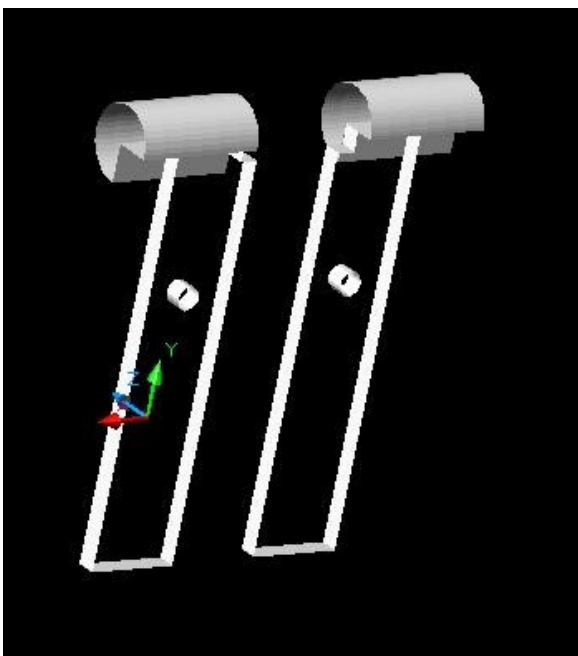


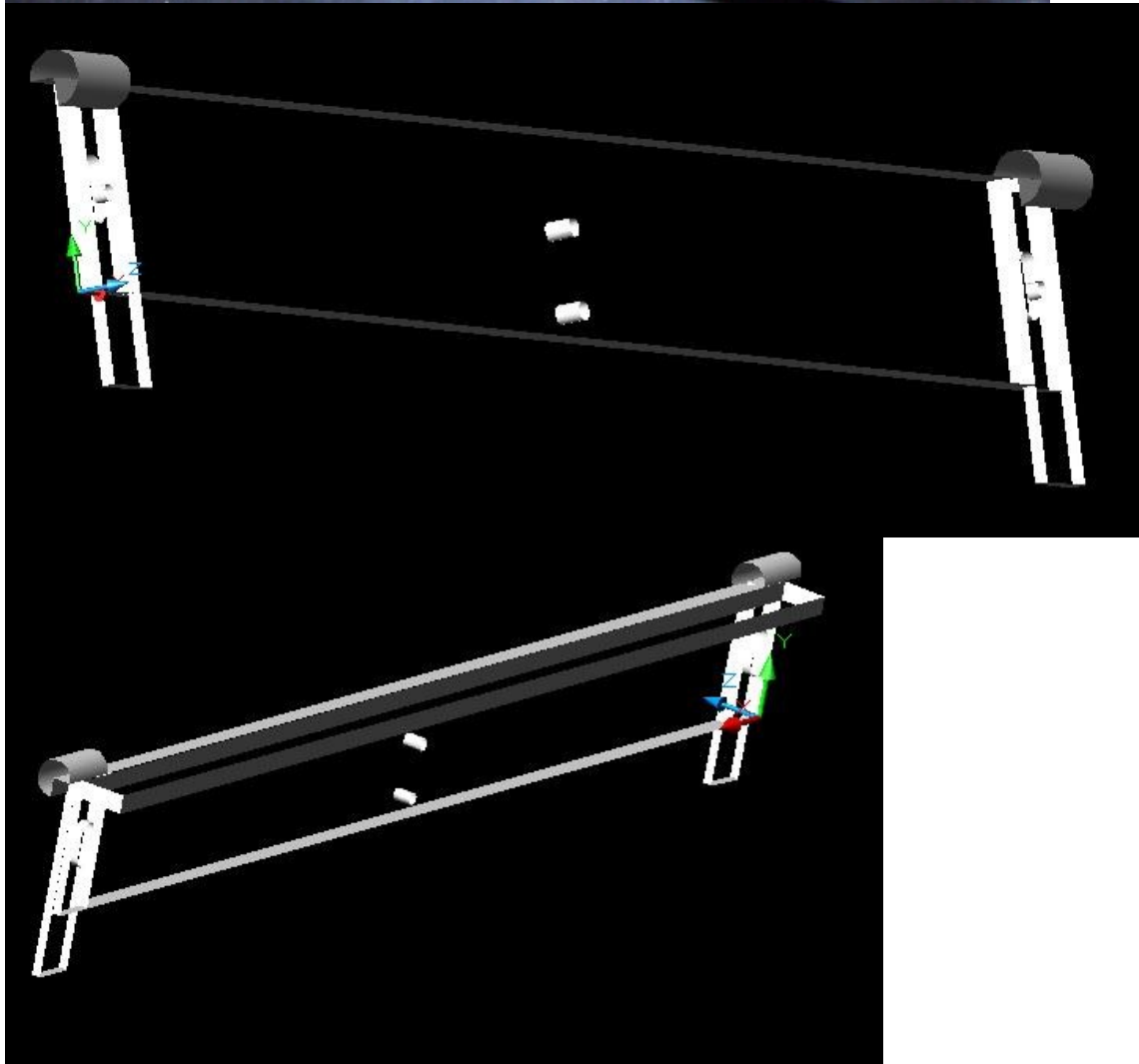
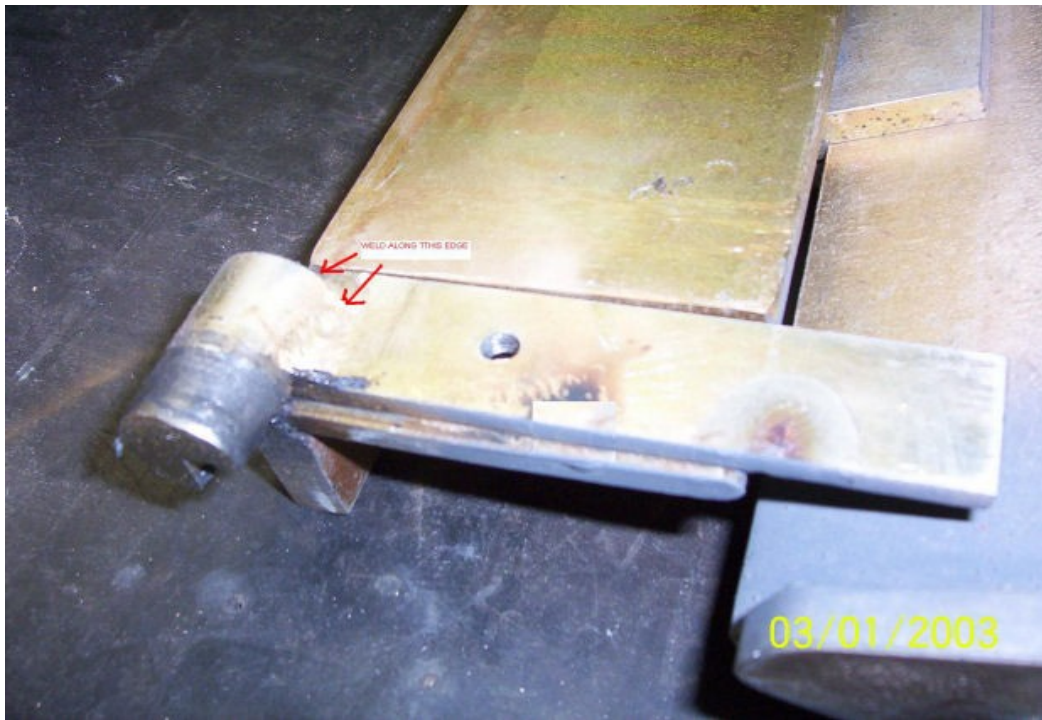
Step 11 Okay lets put the bits together, fist well take your adjustment arms and your pivot units and weld them together. Basically take the adjustment arm end with the notch slit into it, place this into the 45 deegred groove of the pivot units and overhang the edge with the cutout, you need to make a left and right unit so the cut outs overhang on the inside edge, now just weld the item into place on the outer edge of the pivot unit, use the attached photo for reference if needed.

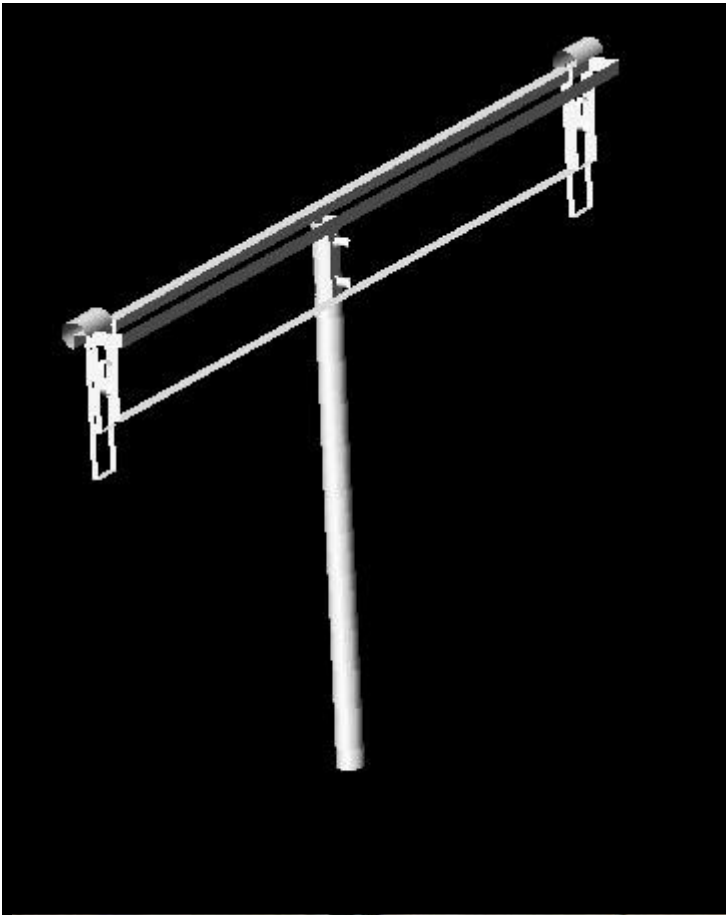
Next bolt these two slides onto the main fold arm this is the unit with the 25mm milled edge. Now bolt the handle to the back side

And lastlty the brace, butt this against the top front edge to extend the 10mm width to now 35mm width, you can either weld it into place or if you so choose drill and tap the unit in place, your call.

The lift mechanism is now complete, undo the bed base plate from the ends slide this unit into the front 20mm holes use a bit of grease and then bolt the base bed back on. Hope it all makes sense



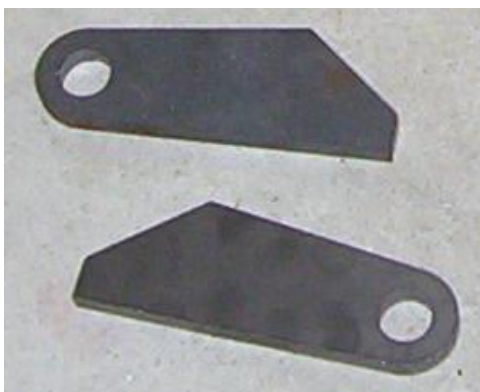
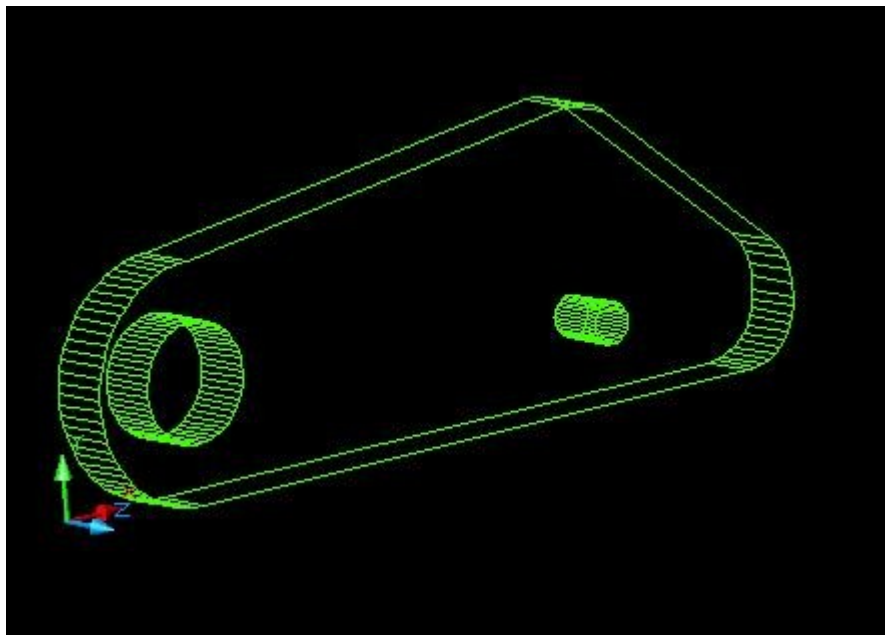
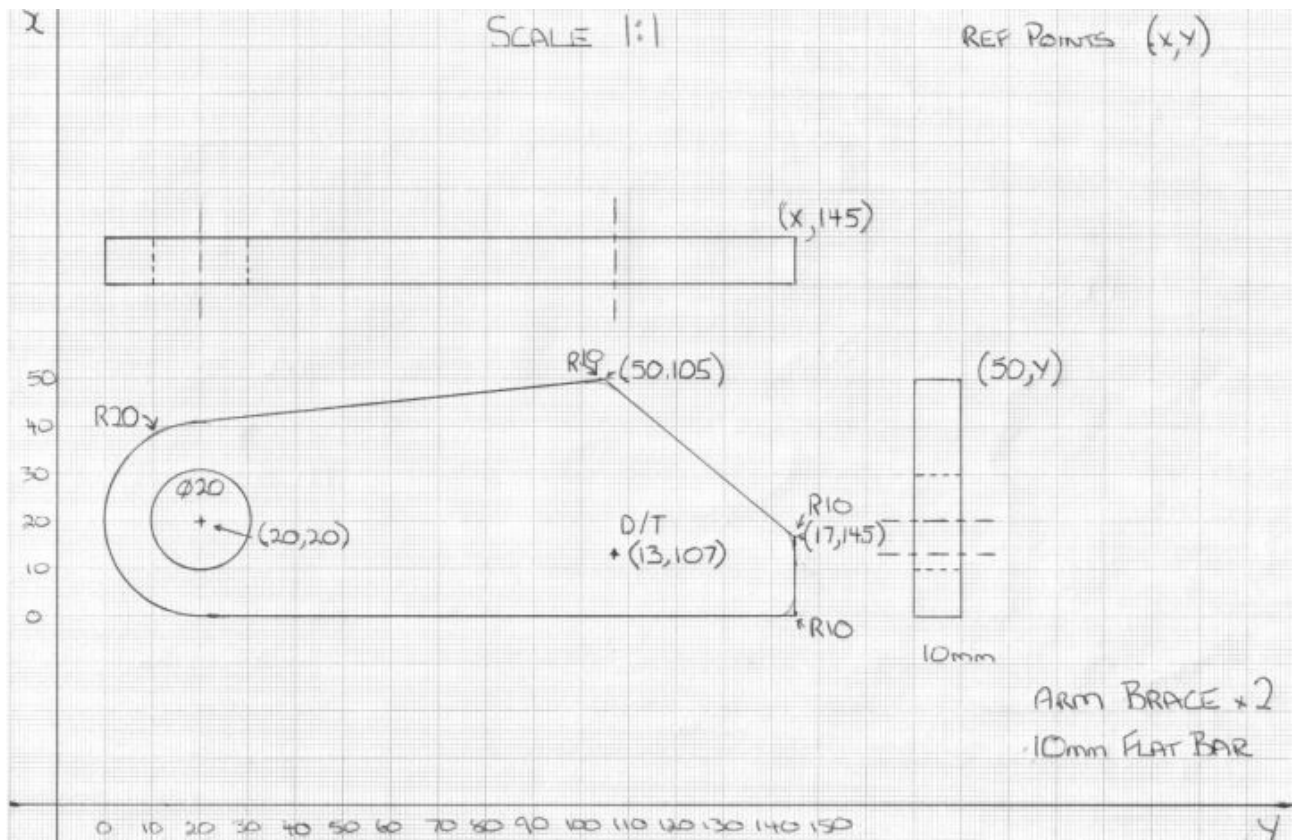






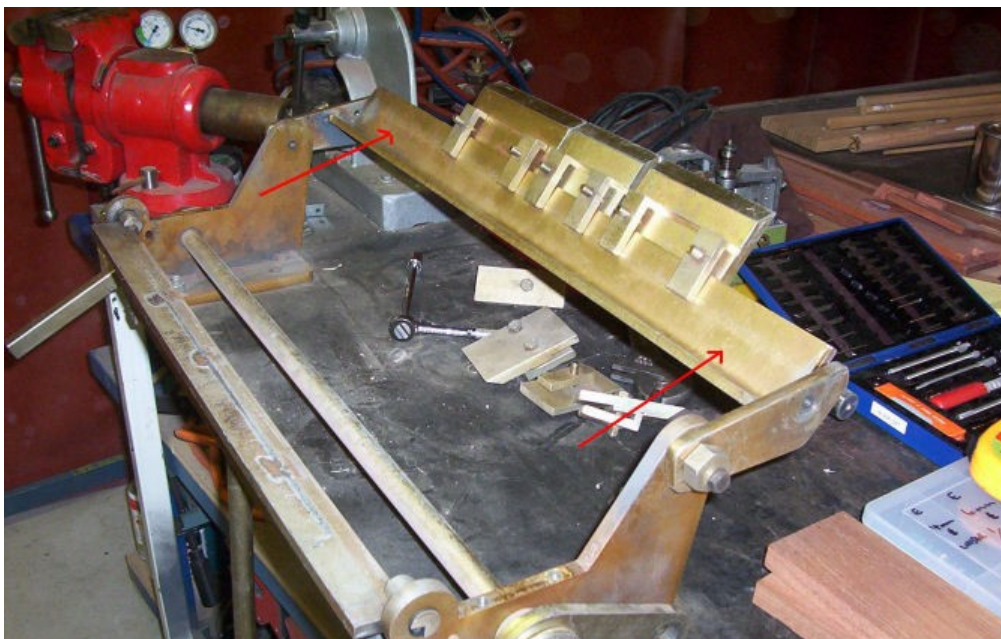
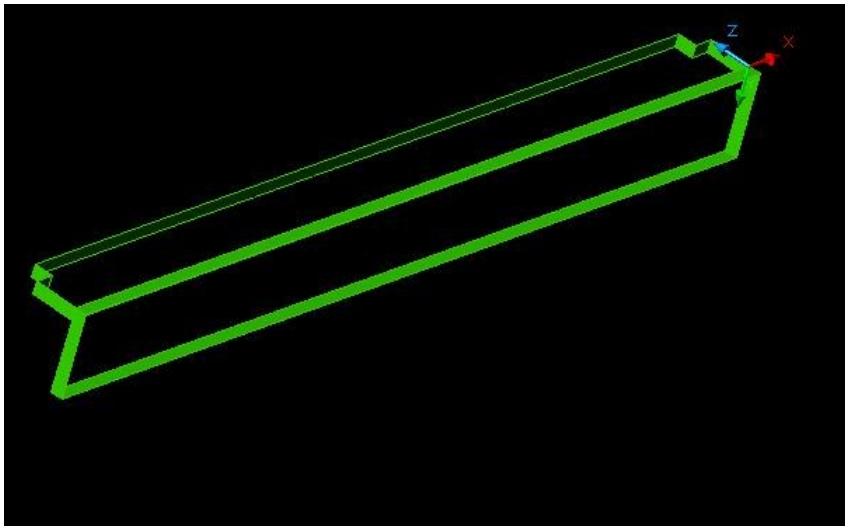
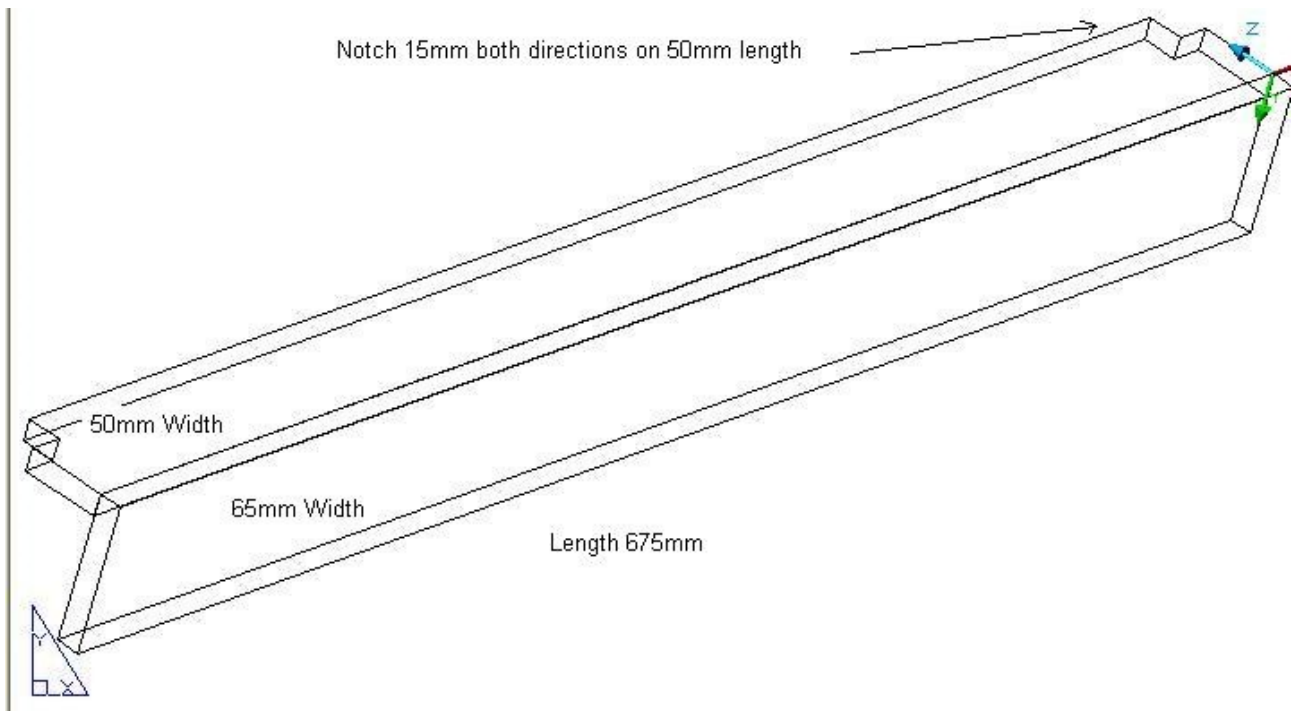


Step 12 Okay there are two of these units they allow the clamping assy to move up and down and backwards and forwards. For info when you bend a piece of steel you adjust the clamping fingers back from the main edge of the bed by the thickness of the steel your bending, if you don't move them back then when you raise your lifting assy youll snap of the front edge of your fingers. Mmm not good that's for sure. Okay the drawing is for aesthetics, you can use just a piece of square if you want. 10mm thick, 145 mm long and 50mm high. These can be laser cut for about 5.50 each.

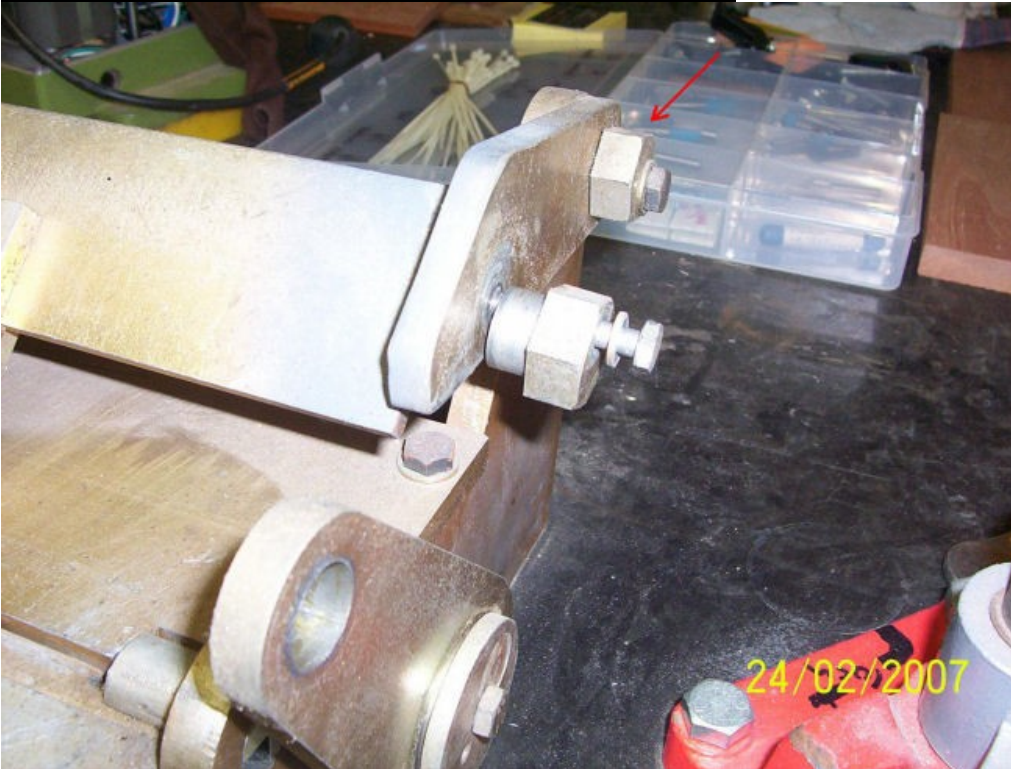
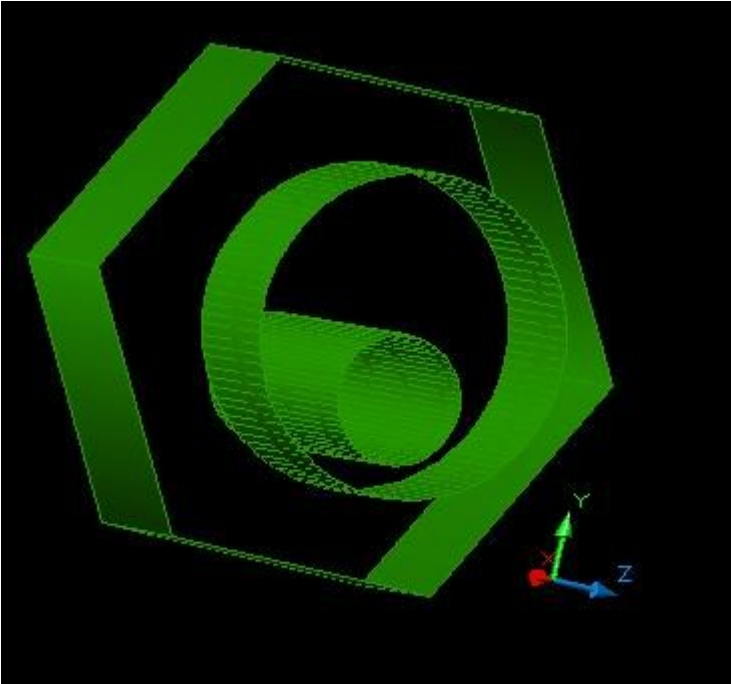




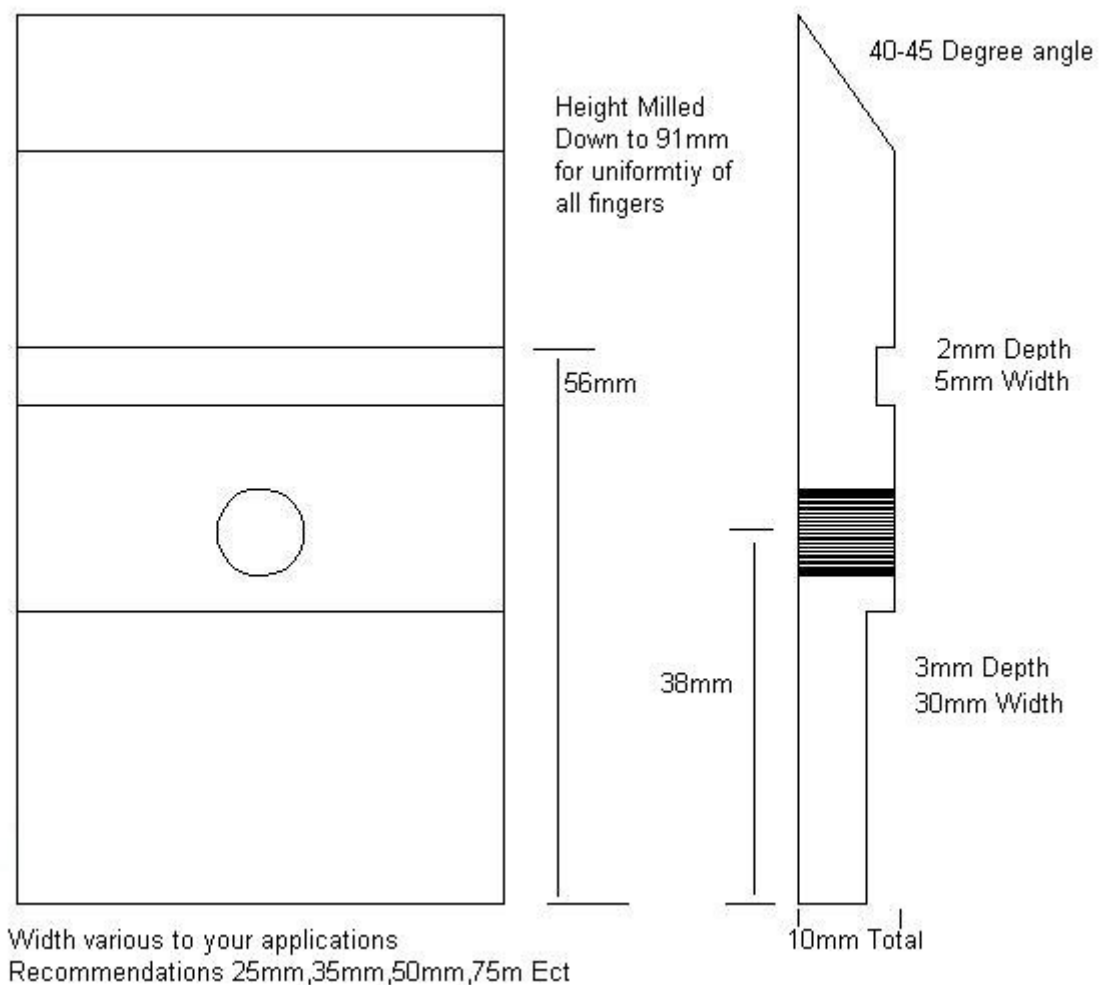
Step 13 This is simply a piece of unequal angle 65mm by 50mm x 6mm thick with a length of 675mm It holds the fingers and supplies the rigidity to hold the sheet solid and square during the fold. If your going to bend thicker steel than 1.6mm then this needs to be 10mm thick or greater, same rule applies if you wish to make the bed wider than the 600mm unit. You need to notch the ends on the 50mm length in to a depth of 15mm with a width of 15mm this is to allow clearance on your base bed end pieces, if you want for aesthetics you can machine the 50mm length to a total thickness of 35mm for the entire length, your choice. The cad picture shows the unit with notched ends, my photo shows where I milled it for the full length.

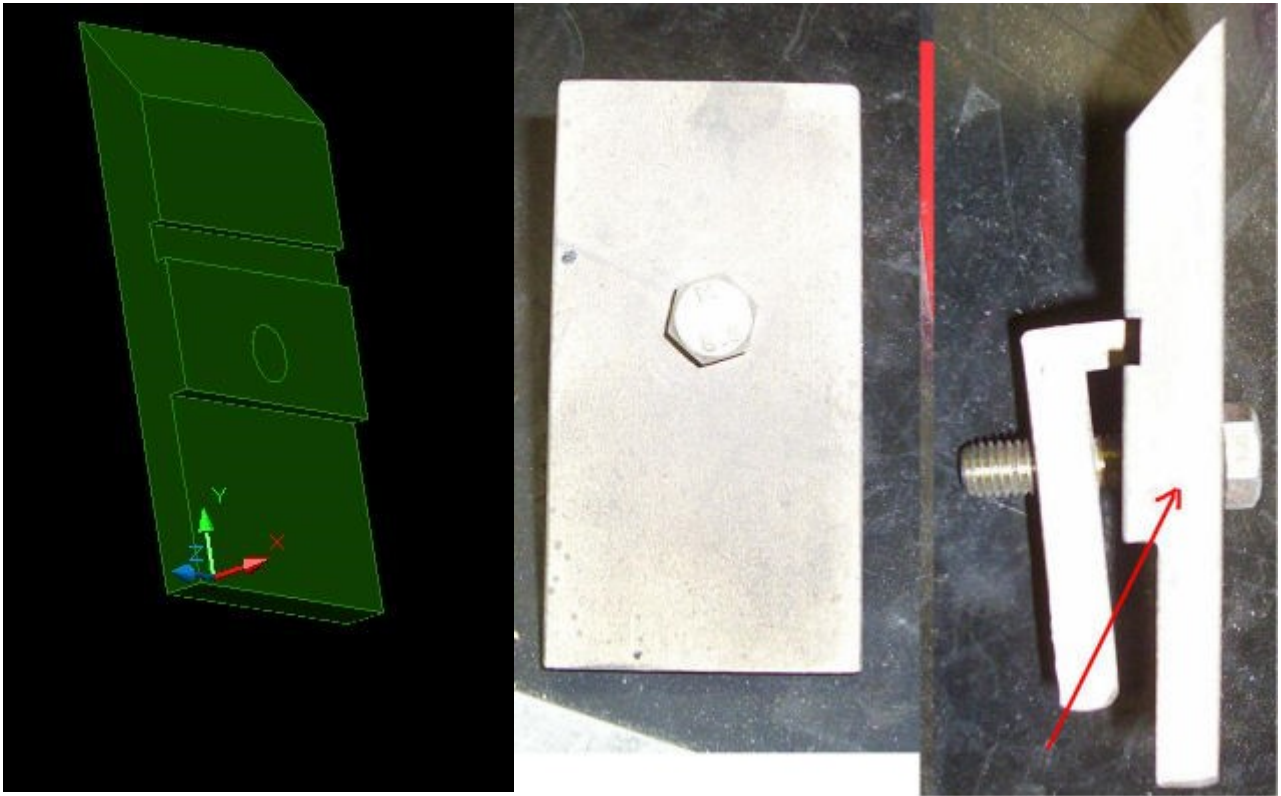


Step 14. This unit allows the end pieces of your clamping assy to be fastened to the bed through the 20mm hole, it also allows the clamping assy to move forwards and backwards by simply turning the hex part of this assembly with a shifter. Okay 2 pieces of 25 - 35mm hex bar 22mm in length with one side turned down to approx 20mm by 10mm length. I say approx because this needs to fit into the clamping assy end piece which you've already made, so if they have a slightly larger or smaller hole then you can compensate for this now. You also need to drill a 8mm hole through the entire piece, off centre by about 5mm, its not critical just so long as you don't drill through the outer wall.

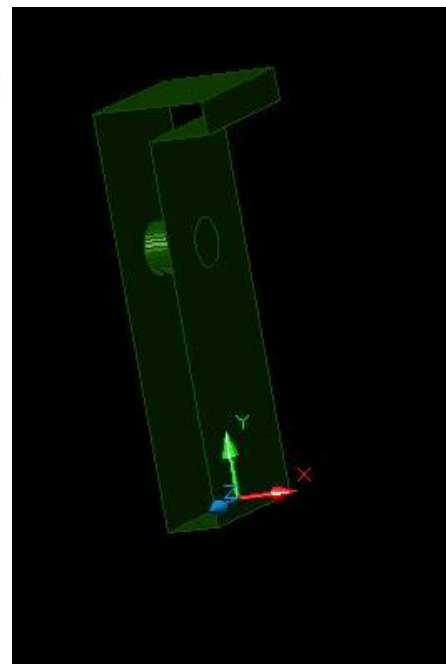
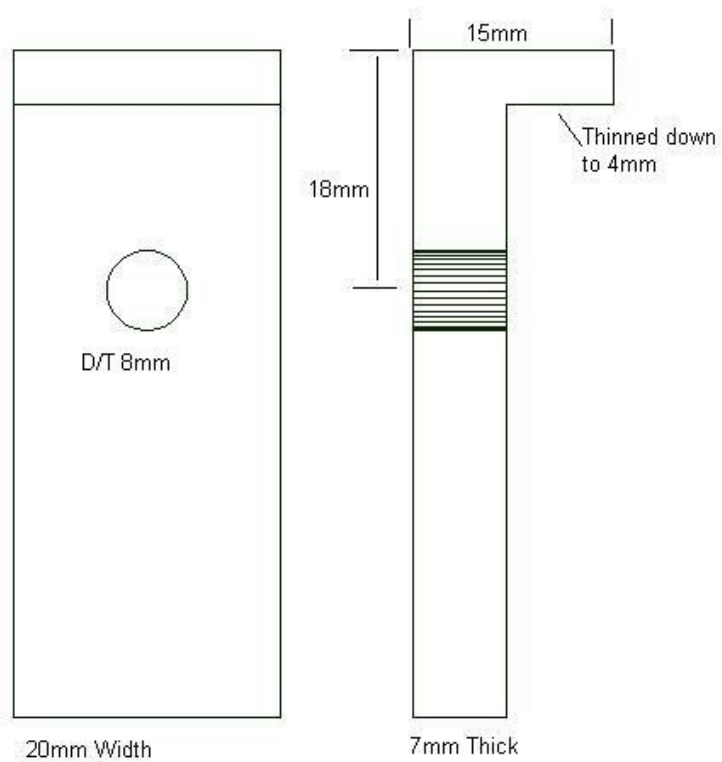


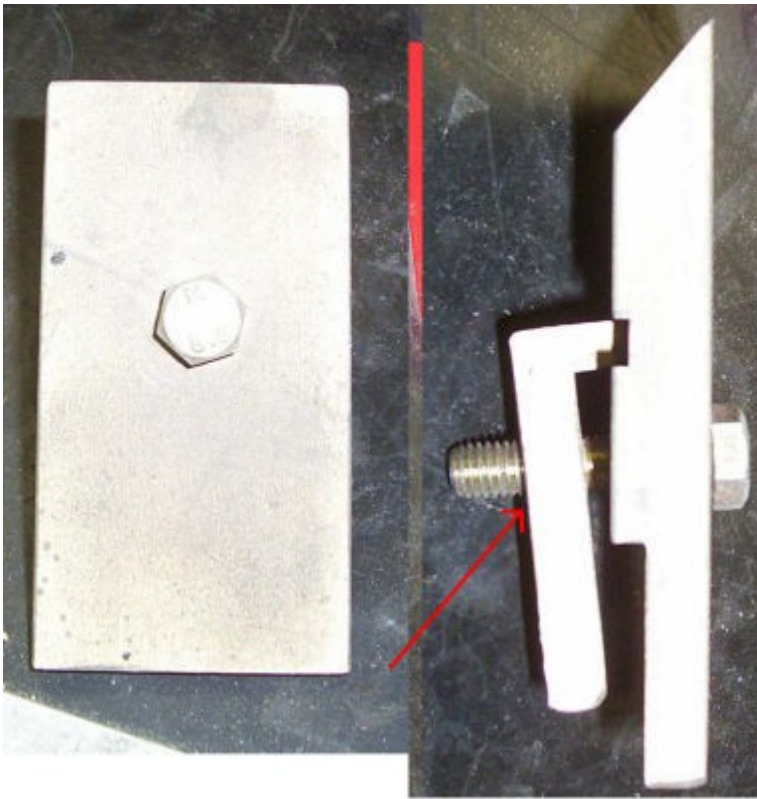
Step 15 This is probably the hardest for most people to do, my recommendations get someone that has a mill to do it for you, you can do these by hand by scribing a line in the waste areas clamping it into a vise and draw filing the items. Basically it's a piece of 10mm thick steel by whatever widths you want with a machined height of 91mm or thereabouts make it a 100 if you want, just make sure there all the same. The top angle is 40 degrees but you can vary this up to 45 degrees if you want as well. The machined section on the bottom is 30mm long by 3mm deep this allows a solid hard face for clamping onto your cross brace. The other relief is simply a key way setup for the clamp brace to lock into, have a look at the pic for a better explanation. The hole is 9mm wide so that way an m8 bolt fits in loosely, if you make 100mm wide units youll want 2 bolt holes 200mm wide units 3 and so on. That's it



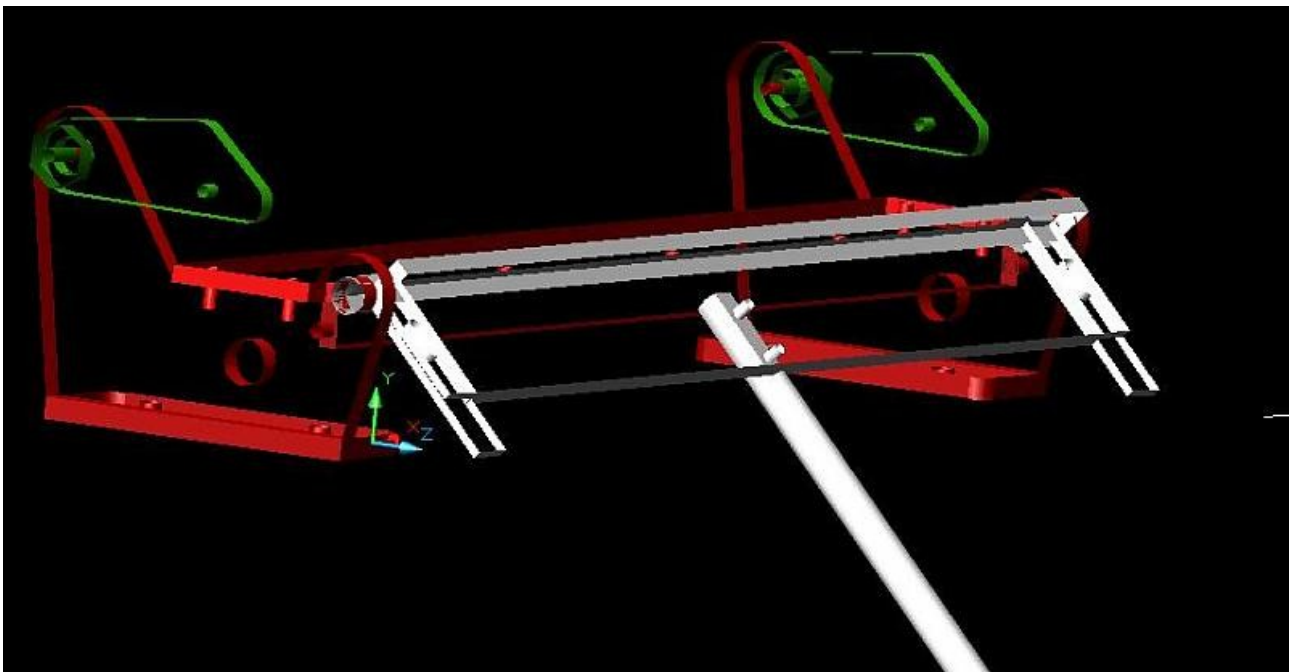


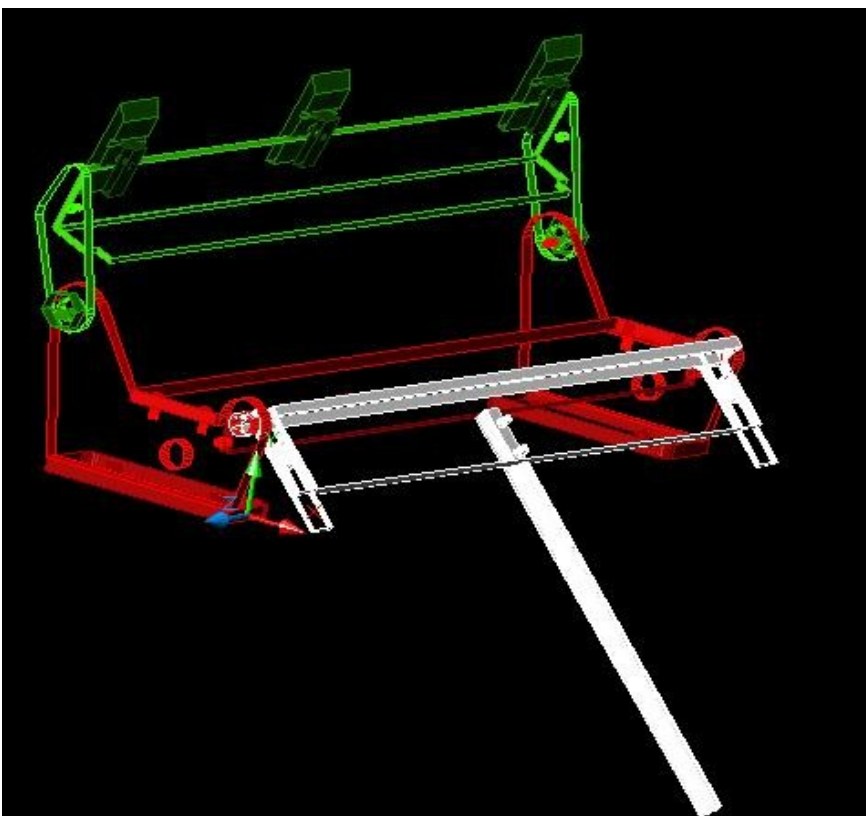
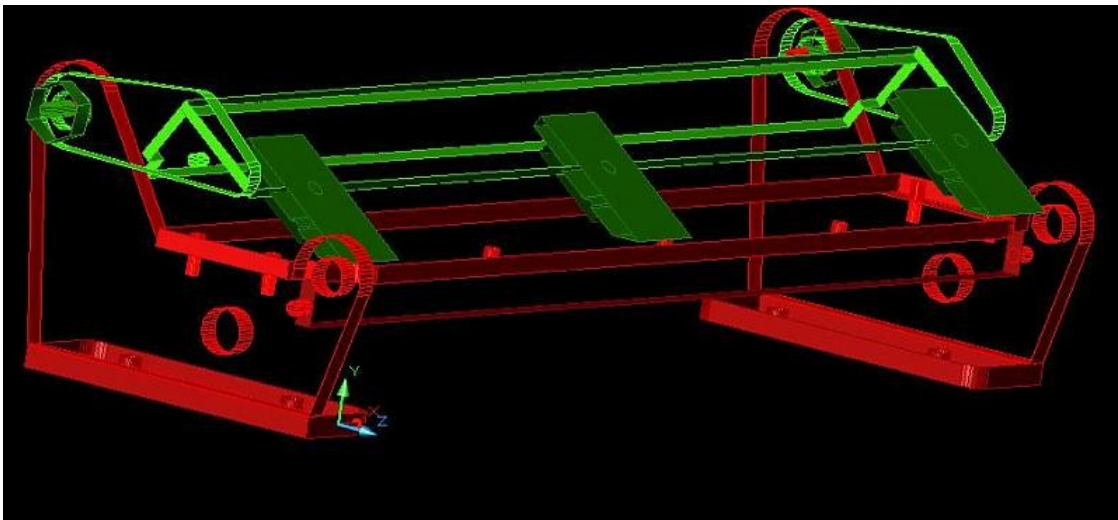
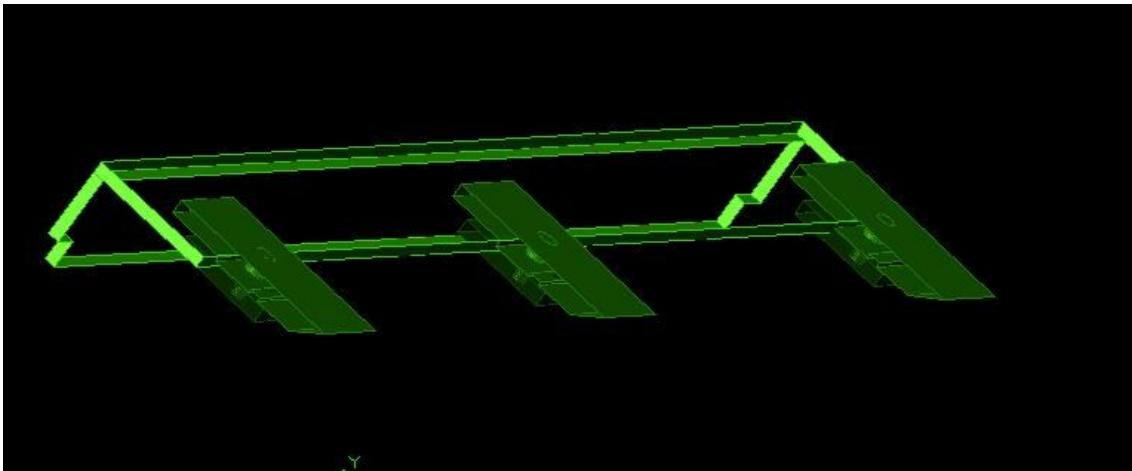
Step 16 Just a bit of angle line here cut down and a hole tapped to allow the finger to tighten into, pic says it all. Next step we will assemble this part of the unit which only leaves one stage to go and that's the locking stage

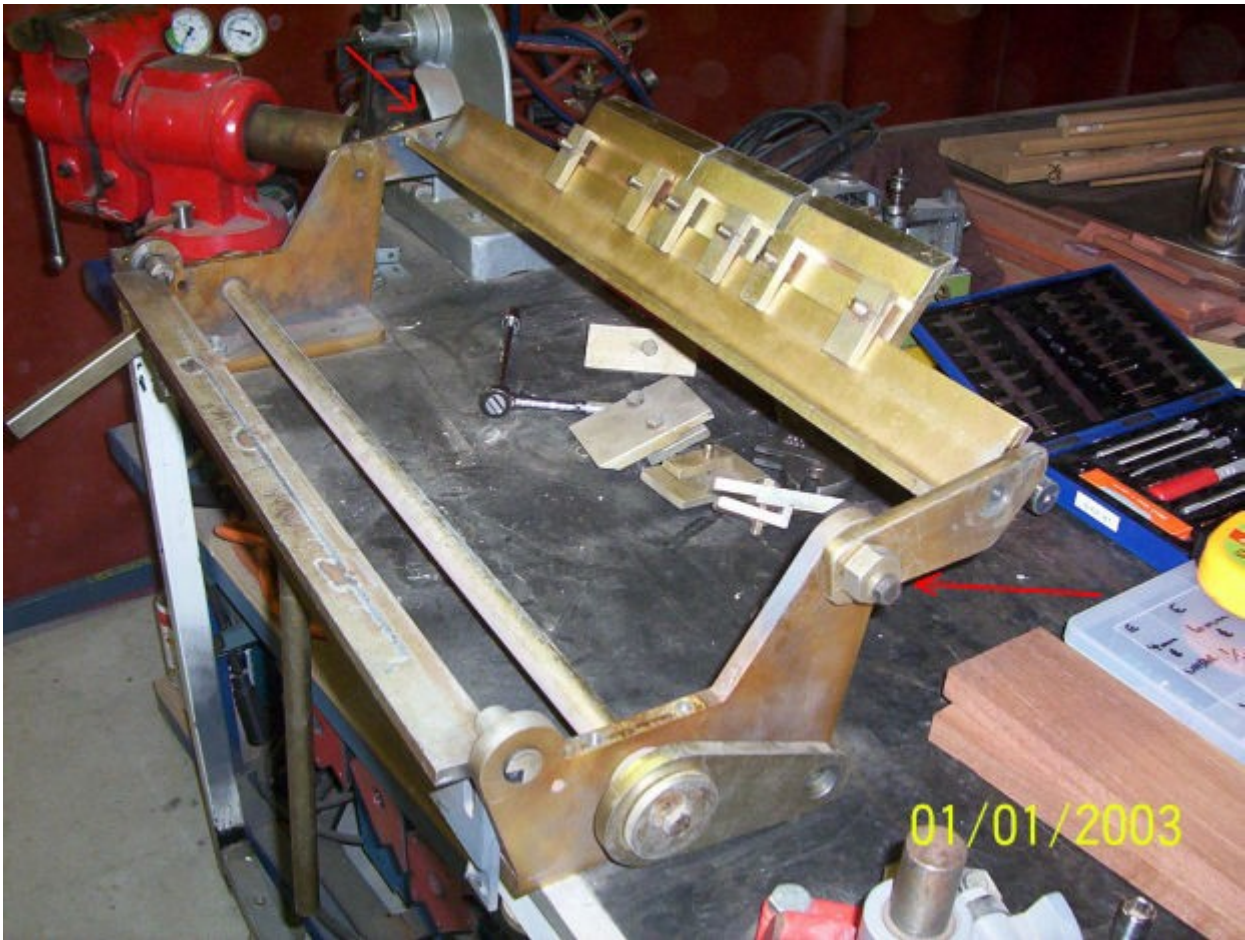




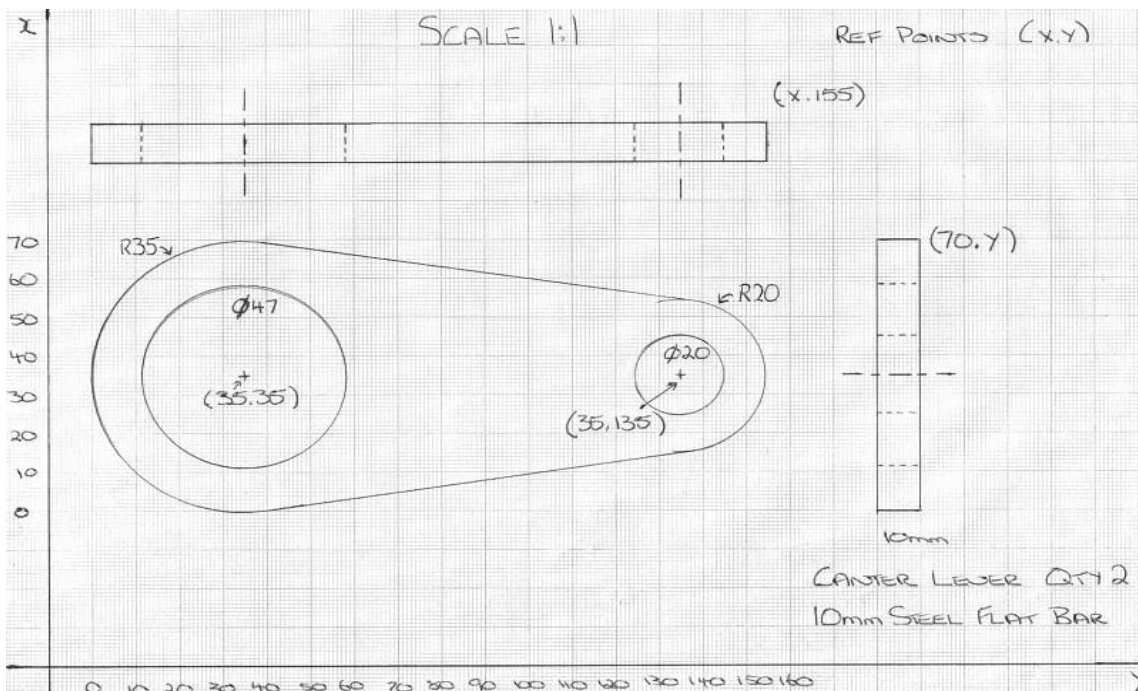
Step 17 Lets assemble the clamping assy. Firstly attach the clamping assy ends onto the base frame end pieces by bolting the pivot units into place, the clamping assy ends sit external to the base ends. Rotate the pivot units so they move the clamping assy end pieces as far forward as possible. Now bolt them down tight so they don't move. Take two fingers and fasten them onto your main arm one at each end. Place the main bar between the clamping assy ends and rest the fingers on the base bed. Lift and prop up the back of the main arm until the fingers are sitting dead flush "this is important", once there sitting nice and squarely tack weld the main arm to the clamping assy ends. Raise the assembled unit up and down a few times to make sure it is square ect and it sits flush and if it does then fully weld the ends into place. That's this step finished You can remove and paint the item if you want as theres no more work required on this part

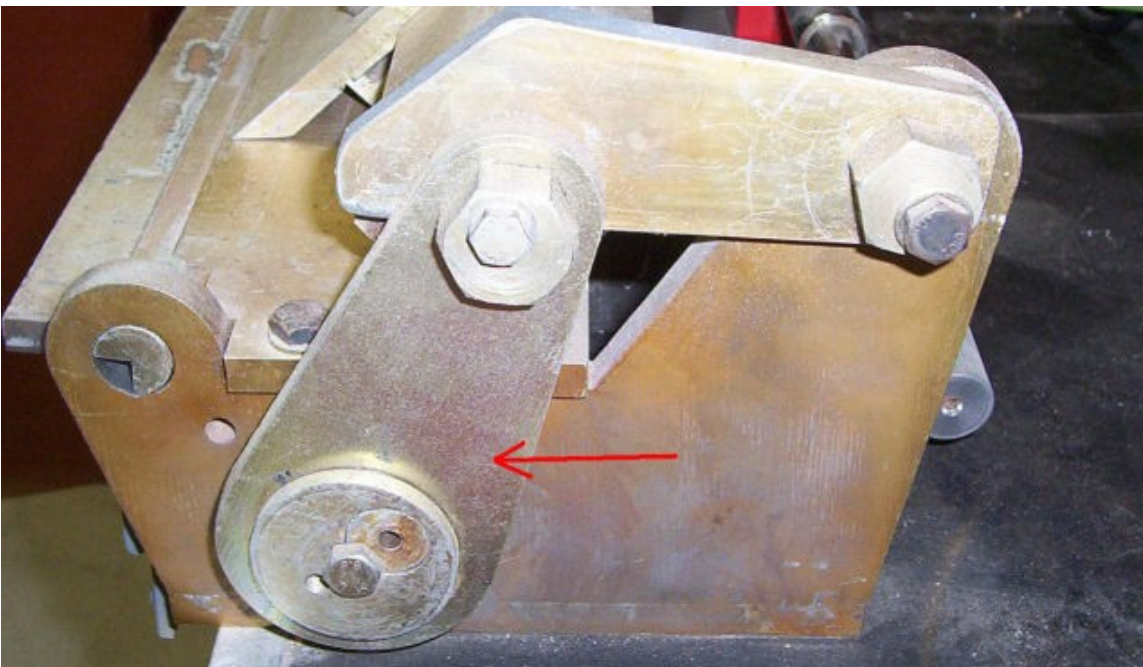
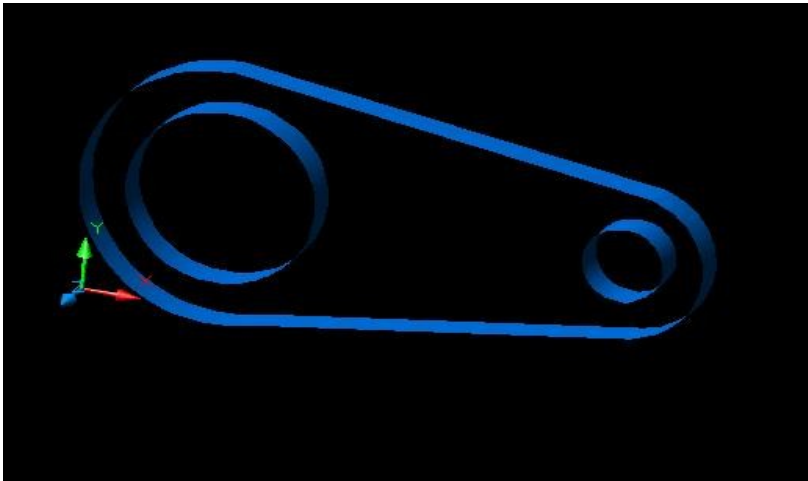




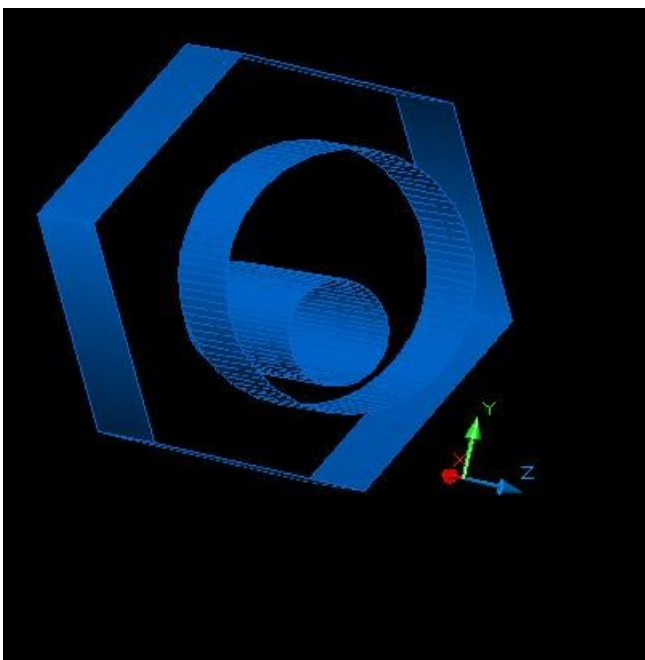
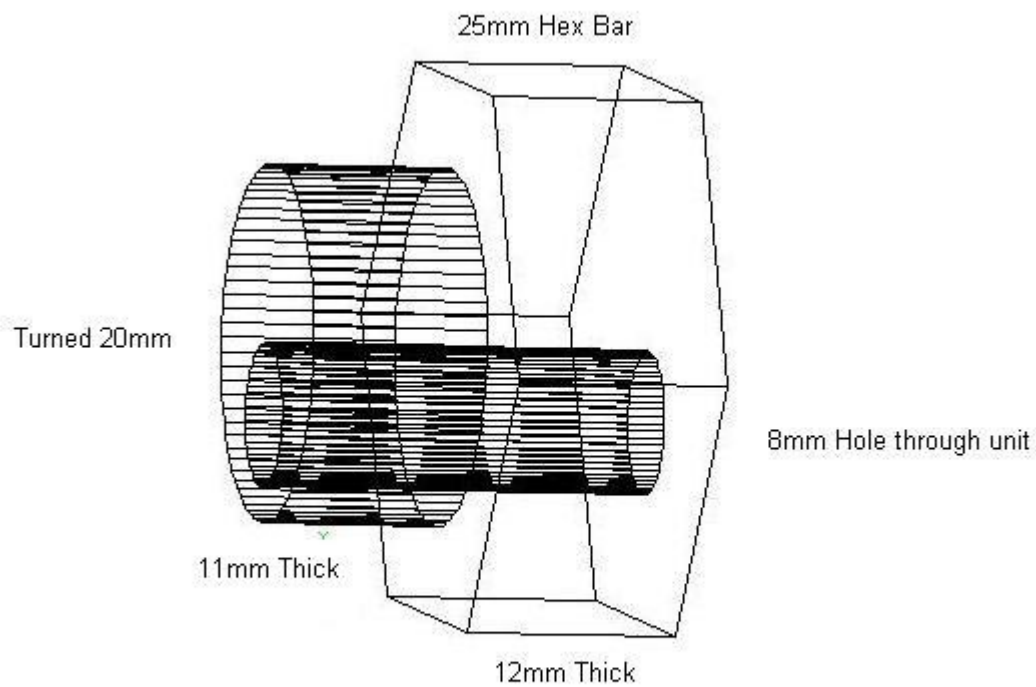


Step 18. Locking Assy canter lever. Okay you need two of these items, they are 155mm long by 70mm wide by 10mm thick, the shape I have given is purely aesthetic, you can use a flat piece with square edges. Laser cut they cost about 8 bucks each. One end has a 47mm hole and the other end a 20mm hole, distance between hole centers is 100mm



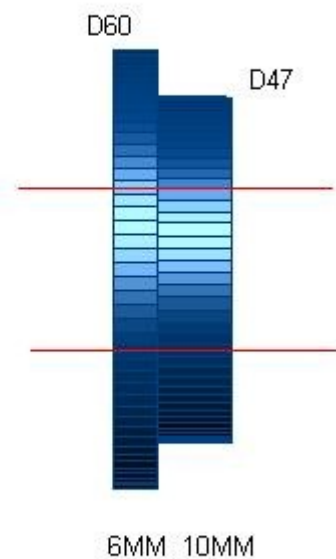
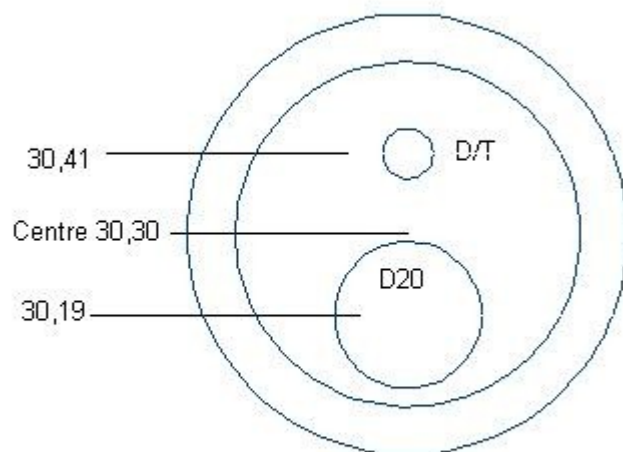


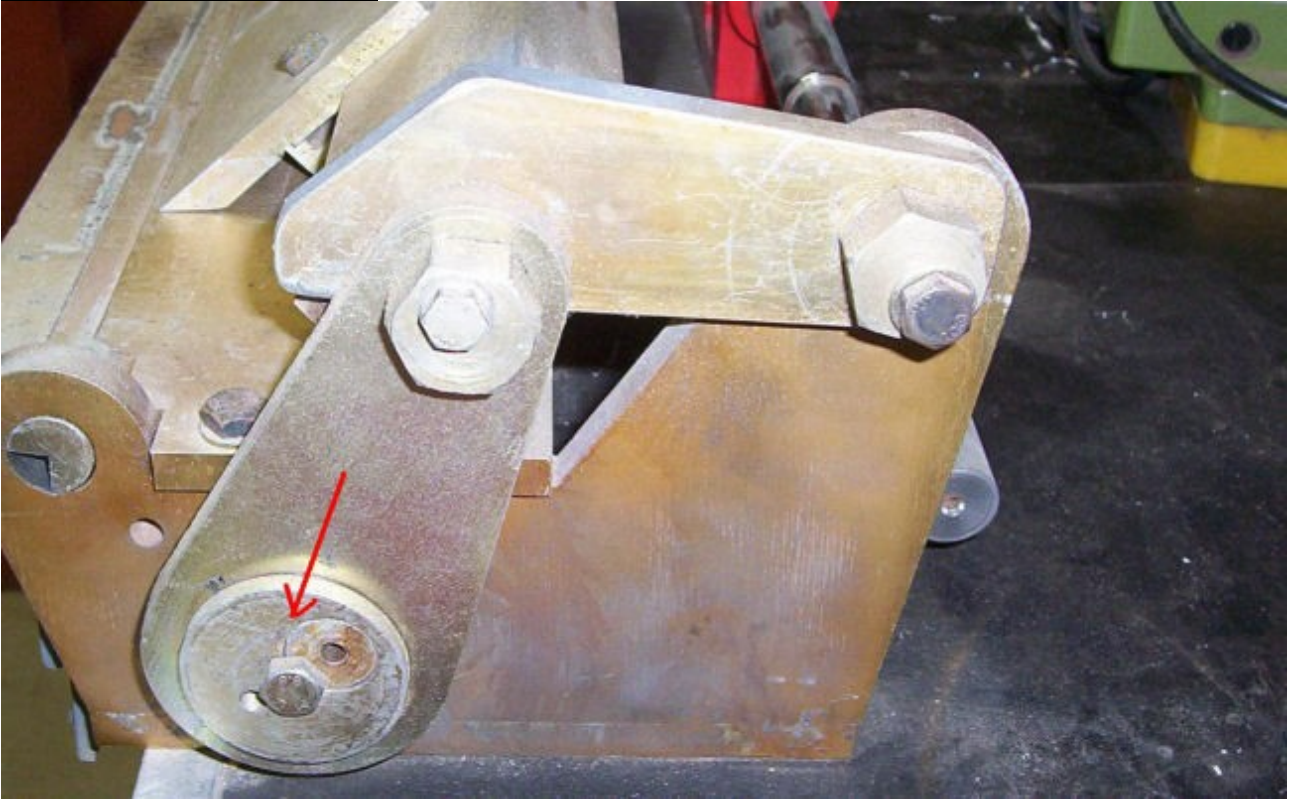
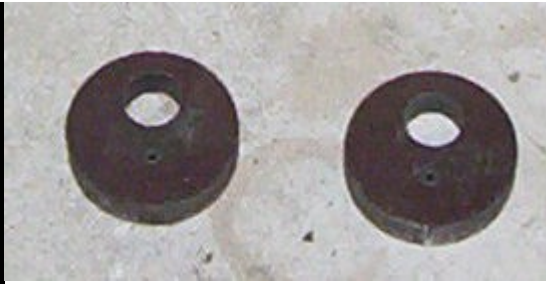
Step 19. This is word for word the same as step 14, so when you make the two for step 14 make 4 so that way this steps done as well, but lets say it again anyway. Okay 2 pieces of 25 - 35mm hex bar 22mm in length with one side turned down to approx 20mm by 10mm length. I say approx because this needs to fit into the locking assy end piece which you've already made, so if they have a slightly larger or smaller hole then you can compensate for this now. You also need to drill a 8mm hole through the entire piece, off centre by about 5mm, its not critical just so long as you don't drill through the outer wall.



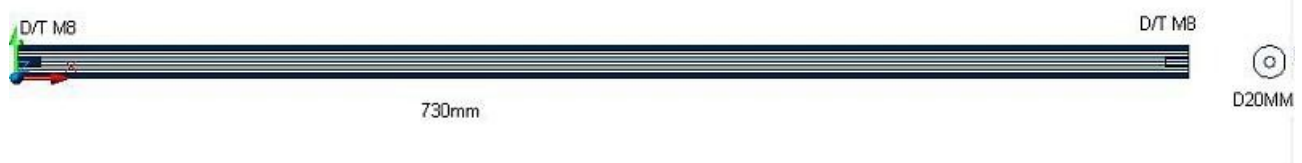


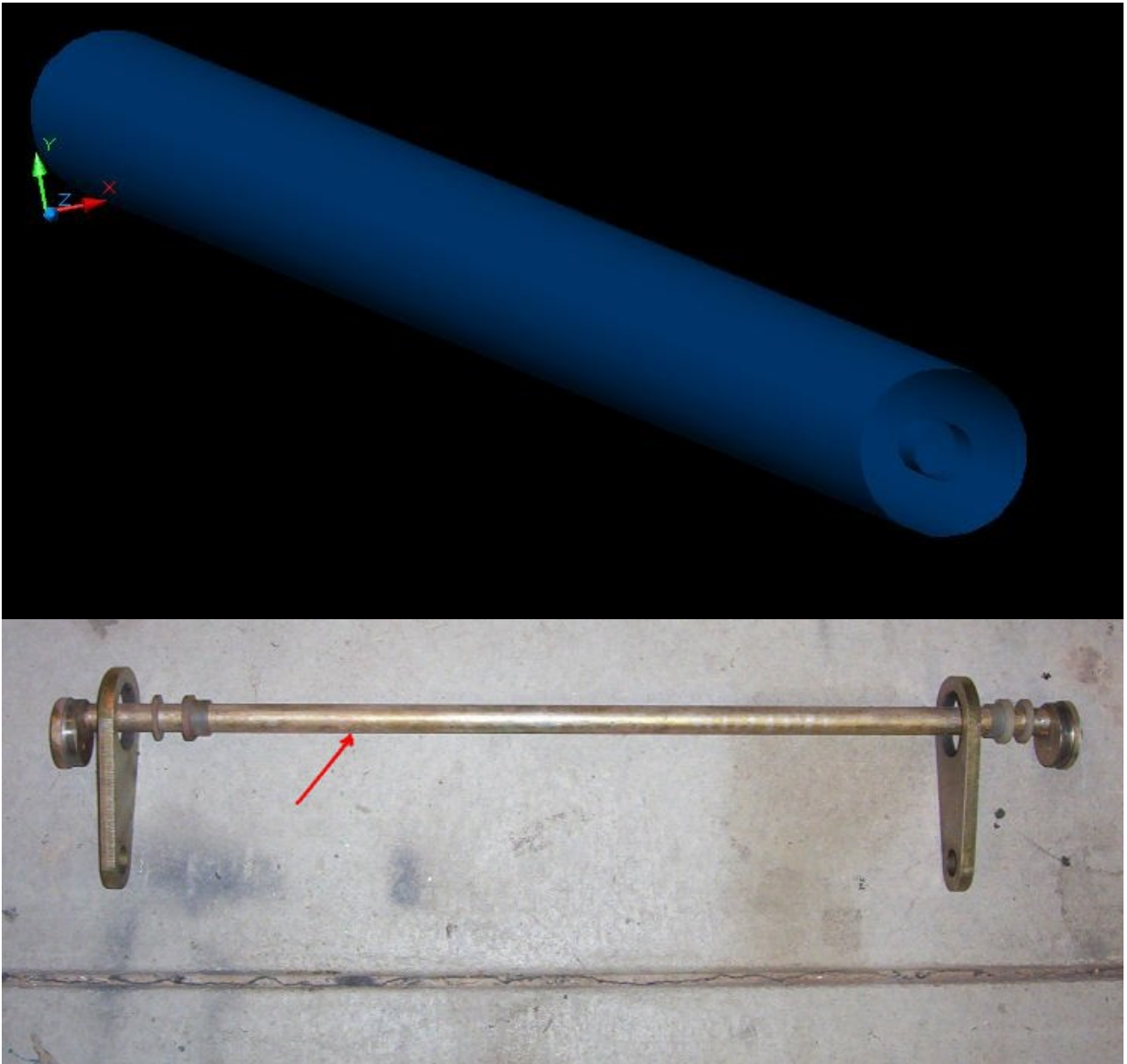
Step 20. This is the pivoter units, it allows the clamping assy to be locked by overcentring the clamping arm. It's two simple pieces of round turned down to fit into the canter levers with a shoulder still present and a 20mm hole drilled of centre and a small m8 hole drilled and tapped for handle attachment later on. Use the drawing supplied for locations and measurement points



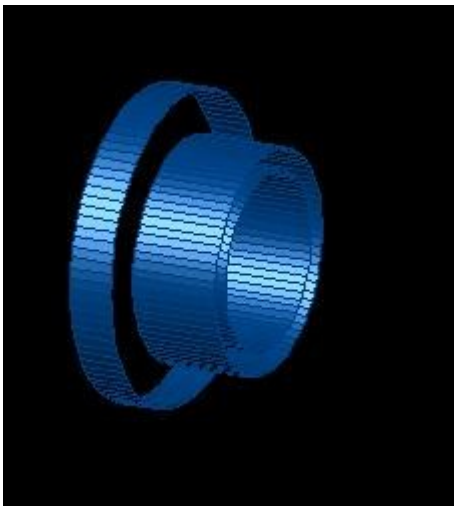
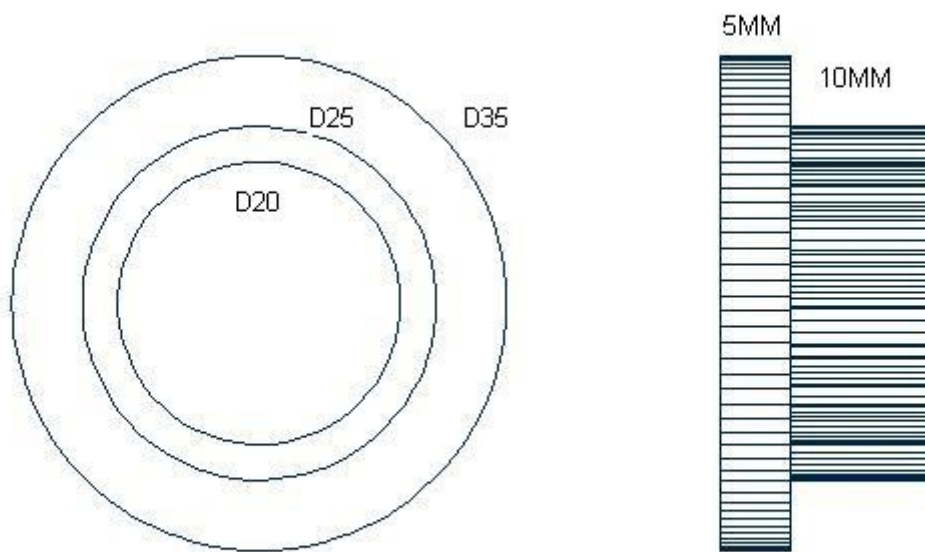


Step 21. Easiest piece to make, it connects the two pivoters together and allows them to turn in unison to each other. It's a 20mm round bar 730mm long with m8 threads drilled and tapped into each end for bolting the handle on later. I recommend whilst you've got this out of the unit, scribe a line through the centre of both ends in the same plane as each other, this will help in jiggging the pivoters squarely when we fit them in the final assembly. Okay one handle and 2 bushes and were finished



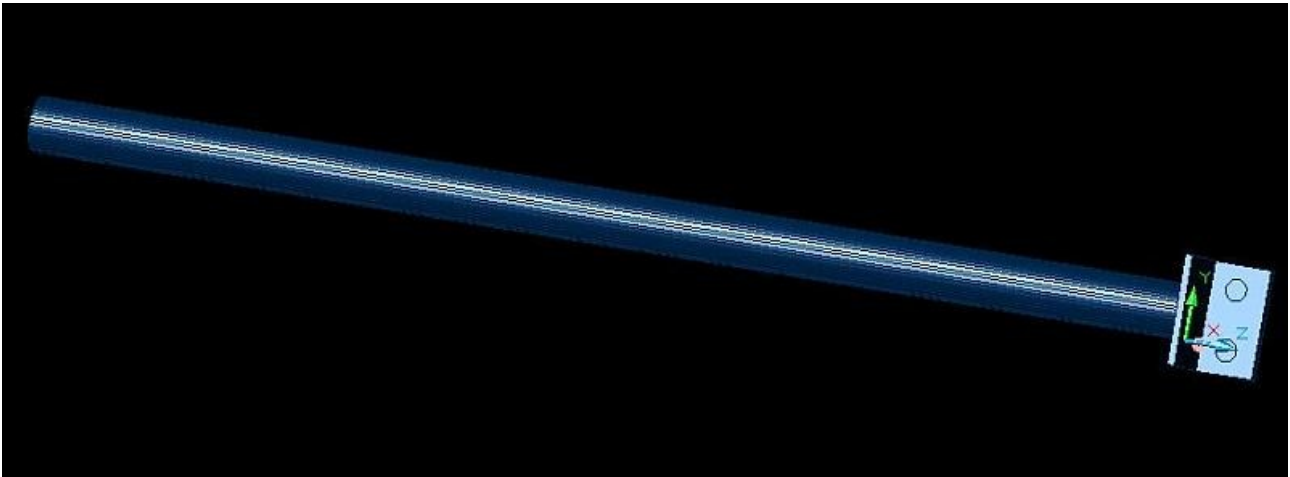


Step 22 Okay there are two of these, they are simply a plastic bush that pops into the 25mm hole in the end pieces from stage 1. It allows the crossbar from this stage to rotate smoothly. The shoulder can be any dia or thickness but I went with 5mm because that gave a bit of strength to the bushing, I would not go greater than 10mm because it may bind the canter levers up during there movement. The center outer bit is 25mm but machine to fit your end pieces and the bore is 20mm but once again machine to suit your crossbar.



Step 23. Last piece and a nice easy one to do as well. Its just a piece of 20mm round or box tube ect about 450mm long doesn't really matter what length and a piece of 25mm angle line welded on the bottom with two holes through it for attaching onto the pivoter unit. That's it no more parts to make, just assemble this stage and wolla one folder completed, with many years of use to come





Step 24. Okay lets assemble the locking mechanism, which also completes the final step in the folder. Insert the plastic bushes from step 22 into the end pieces of your base bed these are the ones you made in step 1. Insert the locking assembly cross shaft though both bushes this is the item from step 21. Now assemble the pivoter item from step 20 into the canter levers from step 18. Push the canter lever over the top of the shaft protruding from your plastic bushes until the end of the cross arm is flush with the pivoter. Now we have to lock the pivoter and cross arm together, I hope you marked a line on each end like I said to in step 21, you have a choice now you can weld the two items together that is the cross arm and pivoter but it meand you will not be able to disassemble the unit again. I like to scotch key the two items together. That is drill a hole between the two pieces and tap a thread and insert a bolt in, havece alook at one of the phots Ive attacehed for clarification. The important thing here is to ensure that both pivoters are in alignment with each other and locked to the shaft. Okay pop in your pivot units from step 19 into the top of your canter levers and bolt them onto the clamping assy ends from step 12. Bolt your handle onto one of the pivoter ends left or right it doesn't matter its universal. And your finished. Yayyyyyy

Now have a play

The rear pivot units move your bed back and forth and the front pivot units vary the clamping force on the job, you want to set this so that way with a piece of 1.6mm steel it overcentre locks, youll see what I mean when you do it.

Enjoy for many years to come

